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The Pinenut Site: Virgin Anasazi Archaeology on the Kanab Plateau of Northwestern Arizona

Deborah A. Westfall

With Contributions by:

Mark C. Bond
William E. Davis
Linda J. Scott
Margaret A. Van Ness

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by

Deborah A. Westfall

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ABSTRACT

This report describes the results of a joint excavation project conducted by Abajo Archaeology and the BLM Arizona Strip District. The Pinenut Site is a Virgin Anasazi habitation located on Water Canyon Point, a southern extension of the Kanab Plateau in the Arizona Strip of northwestern Arizona. Excavation revealed a semi-subterranean pit structure; a room block consisting of 1 living room, 3 storage rooms, 1 activity room; and 1 storage-heating pit, and an isolated slab-lined cist complex. Cumulative evidence revealed that the site was occupied during at least three distinct episodes: the first occupation occurred in the A.D. 1050-1100 interval, and the subsequent two occupations were during the A.D. 1200-1250/1275 time span. Material culture patterns and subsistence data show that each occupation was probably restricted to the summer season and that the site inhabitants practiced a mixed horticulture-foraging subsistence strategy. Diagnostic material culture attributes show that group interaction was largely internal within the Virgin Anasazi cultural tradition and that there was little interaction with the Kayenta Anasazi in spite of the site's proximity to the northern Kayenta Anasazi frontier.

The results of the Pinenut Site study were evaluated in the context of Anasazi adaptational strategies on the southern Colorado Plateaus. The results indicate that the initial occupation of the site was probably made in response to generally salubrious environmental conditions during the A.D. 1050-1150 interval. During this time Virgin Anasazi groups established horticultural settlements on Water Canyon Point that were based on dry-land farming techniques using water control devices. Several large formal C-shaped pueblos on Water Canyon Point which contain both Virgin and Kayenta Anasazi ceramics indicate some inter-cultural exchange, but negative evidence suggests that the Pinenut Site inhabitants did not participate in this interaction sphere. After a hiatus, the Pinenut site was re-occupied around A.D. 1200, by which time the Kayenta Anasazi had largely abandoned the Arizona Strip and adjacent Grand Canyon regions. Two discrete construction episodes at the site suggest there were two occupational phases and material culture patterns show that seasonal horticulture-foraging again was the preferred subsistence strategy. It is suspected that high water tables on Water Canyon Point may have been conducive to natural and artificially enhanced catchments for horticulture, and that accessible springs in the near vicinity alleviated an otherwise dry precipitation regime. The final abandonment of the site around A.D. 1275 may have occurred in response to the Great Drought of A.D. 1275-1300.

ACKNOWLEDGEMENTS

It is a pleasure to acknowledge the numerous individuals who contributed both material and moral support throughout the progress of this study. Personnel in the Arizona State Office and the Arizona Strip District of the Bureau of Land Management are recognized for providing overall guidance for the Pinenut Archaeological Project. In particular, we are grateful to Mr. Rob Roudabush and Ms. Jennifer Jack of the Arizona Strip District Office, and to Mr. Gary Stumpf of the Arizona State Office for recognizing the significant research potential of the Pinenut Site, for obtaining the necessary funding for the laboratory analyses of the cultural materials, and for their sensitive and diplomatic management abilities throughout the progress of this project.

Energy Fuels Nuclear, Inc. contributed substantial funds for the fieldwork and report preparation phases of the project and also donated additional funds for an archaeological survey of the Water Canyon headwaters. We are pleased to acknowledge the generous assistance of Mr. Robert Steele (then of EFN), Mr. Brad Doores, and Mr. Roger Smith during the fieldwork phase of the project, and special thanks are due to helicopter ace "A.J." for ferrying critical supplies to the field crew and for assistance in aerial photography. We also thank Mr. Tom Rasmussen and Mr. Jim Rasmussen of EFN for contributing their specialized knowledge of the geology of the project area. Mr. John Vaughn generously shared his unique knowledge and deep understanding of the Arizona Strip region so that the context of the Pinenut Site could be better understood.

The successful completion of the excavation phase of the Pinenut Archaeological Project was due to the cooperative efforts of a number of individuals. BLM personnel who contributed their special knowledge and skills were Ms. Jennifer Jack of the Arizona Strip District and Mr. Gardiner Dalley and Mr. Douglas McFadden of the Utah BLM Cedar City District. Volunteers from the Arizona Strip District Office who contributed moral and muscular support included Mr. William Lamb, Ms. Ilene Anderson, and Ms. Candace Duck. Mr. Bob Parry, an avocational archaeologist with the Utah Statewide Archaeological Society is also thanked for assisting with the excavation of the site. Special praise is due to Mr. Christopher Coder, Mr. William Davis, Ms. Helen Fairley, and Mr. Tim Smart who made up the Abajo Archaeology contingent of the field crew and whose wilderness skills made for a highly enjoyable field expedition.

Special thanks are extended to a number of individuals who contributed their specialized knowledge to the analyses of material culture from the Pinenut Site. Mr. Ralph Howe of Bluff, Utah identified the types of rocks in the lithic artifact collections and Mr. Keith Montgomery of Abajo Archaeology generously shared his special knowledge of lithic technology. Ms. Jacki Montgomery, also of Abajo Archaeology identified the faunal bone from the site. Mr. Eric Blinman, Dr. Robert Euler, Ms. Helen Fairley, and Mr. Dean Wilson provided helpful suggestions concerning the analysis of ceramics, which are critical to any study in the Virgin Anasazi region. Mr. Gardiner Dalley, Dr. Jeffrey S. Dean, Dr. Robert Euler, Ms. Helen Fairley, Ms. Jennifer Jack, Ms. Trinkle Jones, Mr. Douglas McFadden, and Dr. Richard Thompson all provided helpful advice based on their substantial knowledge of Virgin and Kayenta Anasazi archaeology.

The production of this report was made possible with the assistance of Mr. Gary Stumpf of the BLM Arizona State Office, Ms. Julie Smart, Mr. William Davis, Mr. Joe Pachak, Mr. Richard Howe, Ms. Chris Smee, and Dr. Donna Deyhle. An iron hand in a velvet glove aptly describes Mr. Stumpf's persistent, but always diplomatic efforts to steer this report to the printing office. Julie Smart merits special praise for her typing, editorial, and survival skills through several drafts of this report. Bill Davis likewise put in typing time and also chased gremlins out of the word processor. Mr. Howe edited the text, and Mr. Pachak drafted the artifact illustrations and also produced a fine sketch of the Pinenut Site for the cover. Chris Smee drew the illustration of the Moapa Black-on-gray sherd spoon for Chapter 7; we thank Chris and Donna Deyhle for donating their help to the final assembly of the report.

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CHAPTER I

INTRODUCTION

Abajo Archaeology, in conjunction with the Bureau of Land Management-Arizona Strip District, conducted archaeological excavations at the Pinenut Site [AZ B:6:44(ASM)], located on the southern Kanab Plateau in the Arizona Strip country of northwestern Arizona. The Pinenut Site is located approximately 33 air miles southwest of Fredonia, Mohave County, on public land administered by the Bureau of Land Management-Arizona Strip District (Figures 1.1 and 1.2).

The Pinenut Site is a small habitation site originally recorded by Abajo Archaeology during a survey of the planned Energy Fuels Nuclear, Inc. (EFN) Pinenut Mine area. The site consists of a room block, a slab-outlined pit structure, an isolated storage feature, and a sheet trash midden. Diagnostic ceramics observed on the site include Moapa Gray Ware, Shinarump Gray Ware, and Tusayan Gray Ware: Virgin Series, suggesting a Virgin Anasazi Pueblo I-II occupation. Since few Virgin Anasazi habitation sites had been previously documented on the Kanab Plateau, the Pinenut Site was judged eligible for nomination to the National Register of Historic Places due to its highly significant research potential (Westfall 1985b).

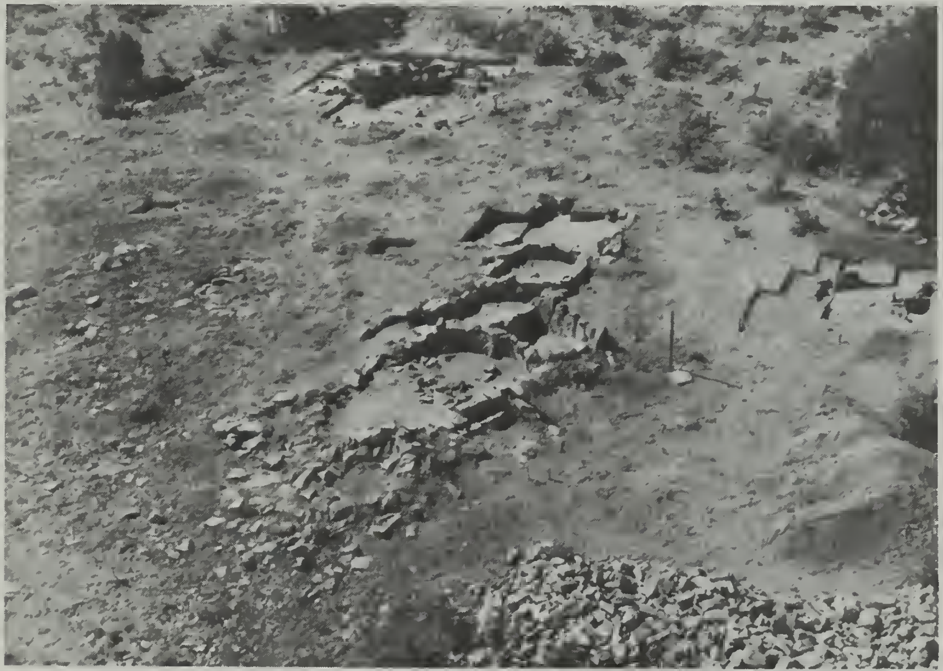


Figure 1.1. Aerial view of the Pinenut Site [AZ B:6:44(ASM], looking south from the north end of the site.

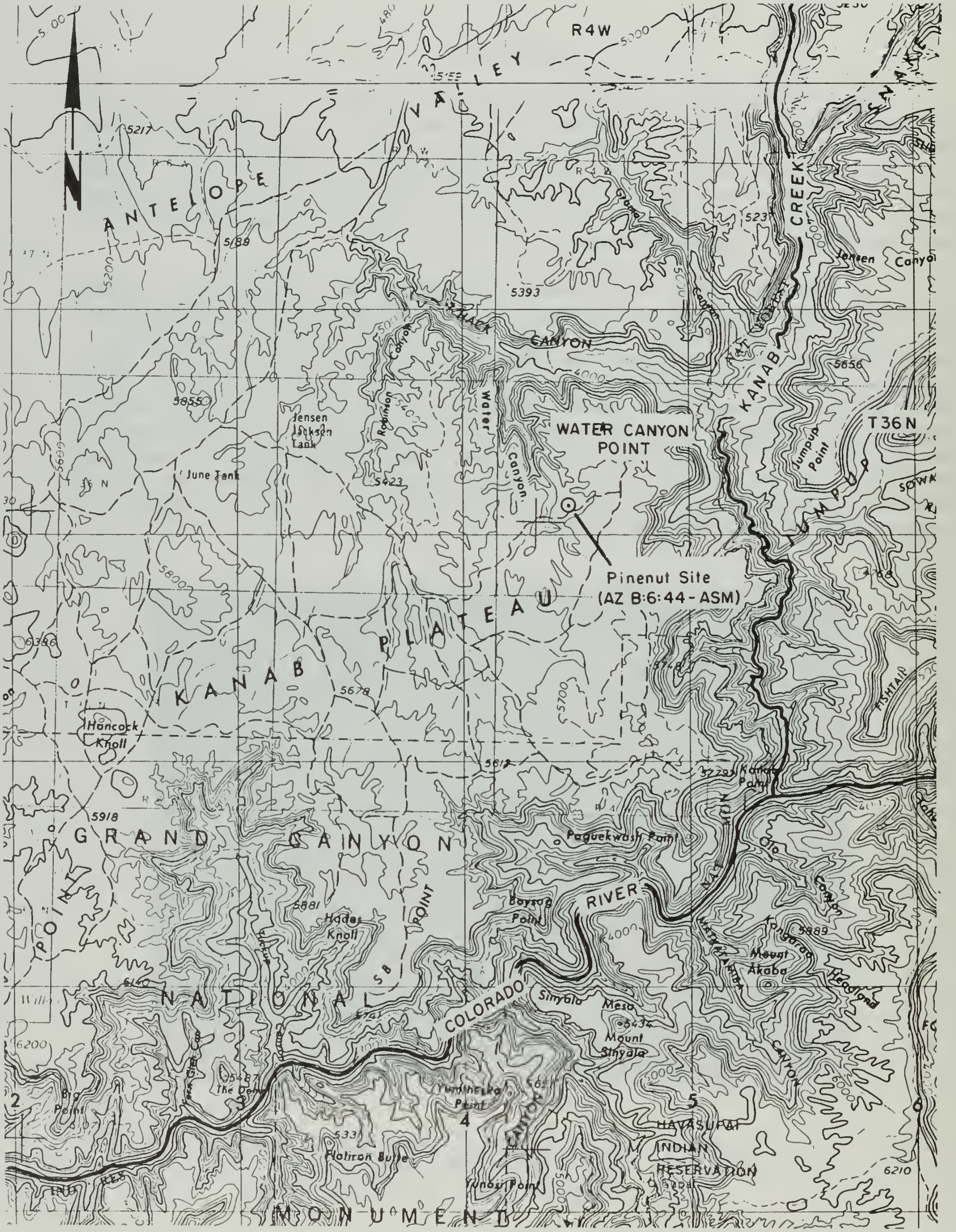


Figure 1.2. Pinenut Project Location Map. U.S.G.S. Grand Canyon 1:250,000. Sec. 21, T36N, R4W, Mohave County, Arizona.

The Pinenut Site was located immediately outside the direct impact zone of the planned EFN Pinenut Mine; however, it was considered vulnerable to potential secondary impacts due to its high visibility proximity to the mine and to increased accessibility created by the improved road to the mine area. Consequently, recommendations were made to mitigate potential adverse effects through a program of archaeological data recovery (Westfall 1985b). Under conditions of the U.S. Mining Act of 1872, the Arizona Bureau of Land Management was required to act upon these recommendations. However, 1985 was a year of government cutbacks and insufficient funds were available to allow the BLM to implement a full-scale data recovery project. Accordingly, Energy Fuels Nuclear, Inc. contributed the necessary additional funds and contracted with Abajo Archaeology to direct the fieldwork and analyses of archaeological data. The Arizona Bureau of Land Management provided funding for laboratory analyses and for the assistance of BLM archaeologists in the data recovery phase of the project.

Excavation of the Pinenut Site was conducted during a fifteen-day period in April 1986, under authority of U.S.D.I. ARPA Permit No. A-21802, issued to Abajo Archaeology, Bluff, Utah. William E. Davis served as Principal Investigator for the project, which was directed by Deborah A. Westfall. The Abajo Archaeology field crew consisted of Deborah A. Westfall, William E. Davis, Helen Fairley, Christopher M. Coder, and Tim Smart. Bureau of Land Management archaeologists who assisted in the fieldwork were Jennifer Jack (Arizona Strip District), Gardiner Dalley (Utah BLM-Cedar City District), and Douglas McFadden (Utah BLM-Kanab Resource Area).

The excavation of the Pinenut Site revealed a series of well-preserved architectural features yielding substantive plant pollen and macrofloral data for reconstructing the prehistoric environment and subsistence resources. The artifact assemblage, while small, has provided insights into prehistoric technology and exchange, and a baseline against which to evaluate future research results. Radiometric dating of burned roof beams yielded a cluster of post-A.D. 1200 dates, indicating continued Virgin Anasazi occupation of the Kanab Plateau long after large numbers of the prehistoric population had abandoned the Arizona Strip region. The archaeology of the Pinenut Site constitutes a useful case study for evaluating the responses of a local prehistoric population to regional paleoenvironmental and demographic changes.

Publication of the findings at the Pinenut Site marks an important step forward in the reconciliation of economic development with the need to protect cultural heritage values. Energy Fuels Nuclear, Inc. contributed generous funds for the excavation project and also funded the archaeological survey of additional acreages on Water Canyon Point to obtain baseline data on the environmental and cultural context of the Pinenut Site. As the lead agency, the Arizona Bureau of Land Management, most notably the Arizona Strip District, worked diligently to discharge its obligation to realize the significant research potential of the Pinenut Site. It is due largely to this unique cooperative effort that a previously unknown locality in the Arizona Strip has contributed significant new information about the prehistory of northwestern Arizona.

CHAPTER II

THE ENVIRONMENTAL AND CULTURE-HISTORICAL CONTEXT OF THE PINENUT SITE

Environmental Setting

The Pinenut Site is located at an elevation of 5440 ft. above mean sea level on a landform known locally as Water Canyon Point on the southern Kanab Plateau of the Arizona Strip (Figure 2.1). The Arizona Strip is within the Colorado Plateau and Basin and Range physiographic provinces. It is bounded on the east and south by the Grand Canyon of the Colorado River, on the west by the Virgin River, and the Shinarump and Vermilion Cliffs border the northern periphery. Important topographic features include the Paria, Kaibab, Kanab, Uinkaret, and Shivwits Plateaus extending from east to west. These plateaus are composed of five basic rock units: the Permian Kaibab and Toroweap Formations, the Triassic Moenkopi Formation and Shinarump Conglomerate, and Quaternary basaltic flows. The Kaibab and underlying Toroweap Formations form the uppermost 500 to 700 feet of strata and constitute most of the land surface of the Arizona Strip. Both the Kaibab and Toroweap formations are composed predominantly of limestone, shale, and gypsum beds which form a gently rolling terrain carved by steep-walled canyons (Hamblin 1986:9). The high permeability of the Kaibab Limestone is a major factor conditioning the relative overall aridity of the Arizona Strip plateaus. Available surface water is largely restricted to a few localized slickrock catchments, springs and seeps near faults, and intermittent streamflow in canyon bottoms. Access to springs and streams, however, is usually constrained by the high, vertical cliff faces of the canyons bordering the plateaus.

The centrally located Kanab Plateau appears as a relatively flat, featureless sagebrush plain when viewed from the horizon. The plateau surface rises gradually in elevation from 4500 ft. at the base of the Vermilion Cliffs in Utah to 5000 ft. at the Grand Canyon North Rim which forms the southern edge of the plateau. In a few localized areas, tectonic forces have elevated some landforms to 6500 ft. above mean sea level.

Kanab Creek Canyon is the pre-eminent drainage of the Kanab Plateau. Originating in the Southern High Plateaus of Utah, Kanab Creek enters the Kanab Plateau from the north as a narrow, winding creek, becoming a broad, deep chasm 3.5 miles wide and 3000 ft. deep at its confluence with the Grand Canyon 9 air miles southeast of Water Canyon Point. The southern Kanab Plateau in turn is partially isolated by Hack Canyon, a major western tributary of Kanab Creek. Water Canyon Point is an elevated (5378 ft. to 5731 ft.) landform directly southwest of the confluence of Hack Canyon with Kanab Creek Canyon. Water Canyon, from which this landform takes its name, is west-northwest of the Pinenut Site and is characterized by a number of smaller headward drainages

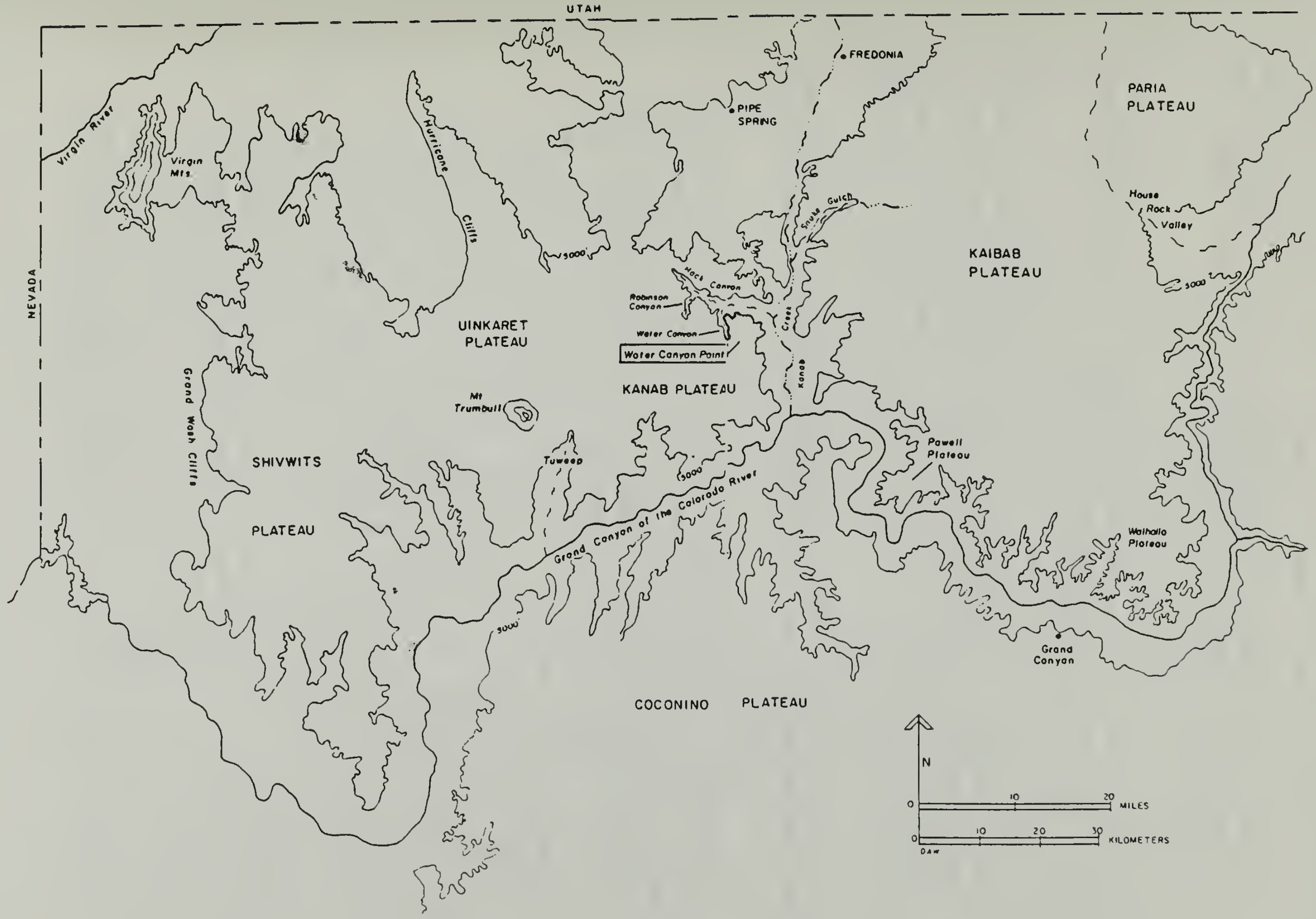


Figure 2.1. The Arizona Strip Region.

which fan out to capture runoff from the southern Kanab Plateau, ultimately debouching northwards into Hack Canyon. The Pinenut Site is situated at the head of one of these unnamed collector drainages, and, as will be seen in the next section, other small Virgin Anasazi sites occur near these headwater drainages on Water Canyon Point. Clearly, these drainage features were important considerations for the prehistoric settlement of Water Canyon Point (Figure 2.2).

In addition to the drainage features cited above, the confluence of Water Canyon, Hack Canyon, and Kanab Creek is also distinguished by a number of springs which occur within a six-mile radius of Water Canyon Point. These are Willow Spring in Hack Canyon to the north, Bessie Spring in Chamberlain Canyon to the east, and Dave's Spring in Scottie's Hollow also to the east. Pictograph panels occur at Bessie Spring and Dave's Spring, clearly demonstrating prehistoric accessibility to these water sources (Jennifer Jack, BLM Arizona Strip District, personal communication 1987). Hence, in this land of little water, access to springs may have been another factor favoring prehistoric settlement on Water Canyon Point.

Gregory (1948:216) provides the best description of the climate of the Kanab Plateau region that is most relevant to Water Canyon Point. His description is cited below:

> As elsewhere in the Colorado Plateau country, the climate of central Kane County is semi-arid and characterized by wide annual, seasonal, monthly, and daily ranges in precipitation and temperature. The climate of the region south of the Vermilion Cliffs at altitudes of 4500 to 5500 feet is fairly well represented by records at Paria and Kanab, and field observations and the accounts of stockmen indicate that, except for a greater snow fall, a few more rainy days, less persistent winds, and somewhat lower temperatures, the climate of the areas above 6000 feet closely resembles that of the lower lands. At Paria (altitude 4700 ± feet) the records show a mean annual precipitation of 8.45 inches, a maximum of 14.09 inches, and a minimum of 4.85, and fairly even distribution throughout the year. Summer temperatures exceeding 100° are normal, but winter temperatures below zero are rare. At Kanab (altitude 4925 feet), the mean annual precipitation is 13.18--7.29 inches for the driest year and 20.70 inches for the wettest year. The heaviest precipitation, about 40 per cent of the annual, comes in January, February, and March, and the lightest in April, May, and June. At this station the average temperature for January is 32.3; for July 74.1--the extremes are 106° and -20°, and normally the lapsed time between the last killing frost of spring and the first killing frost of fall--the growing season for crops--is 151 days; in exceptional years, less than 120.

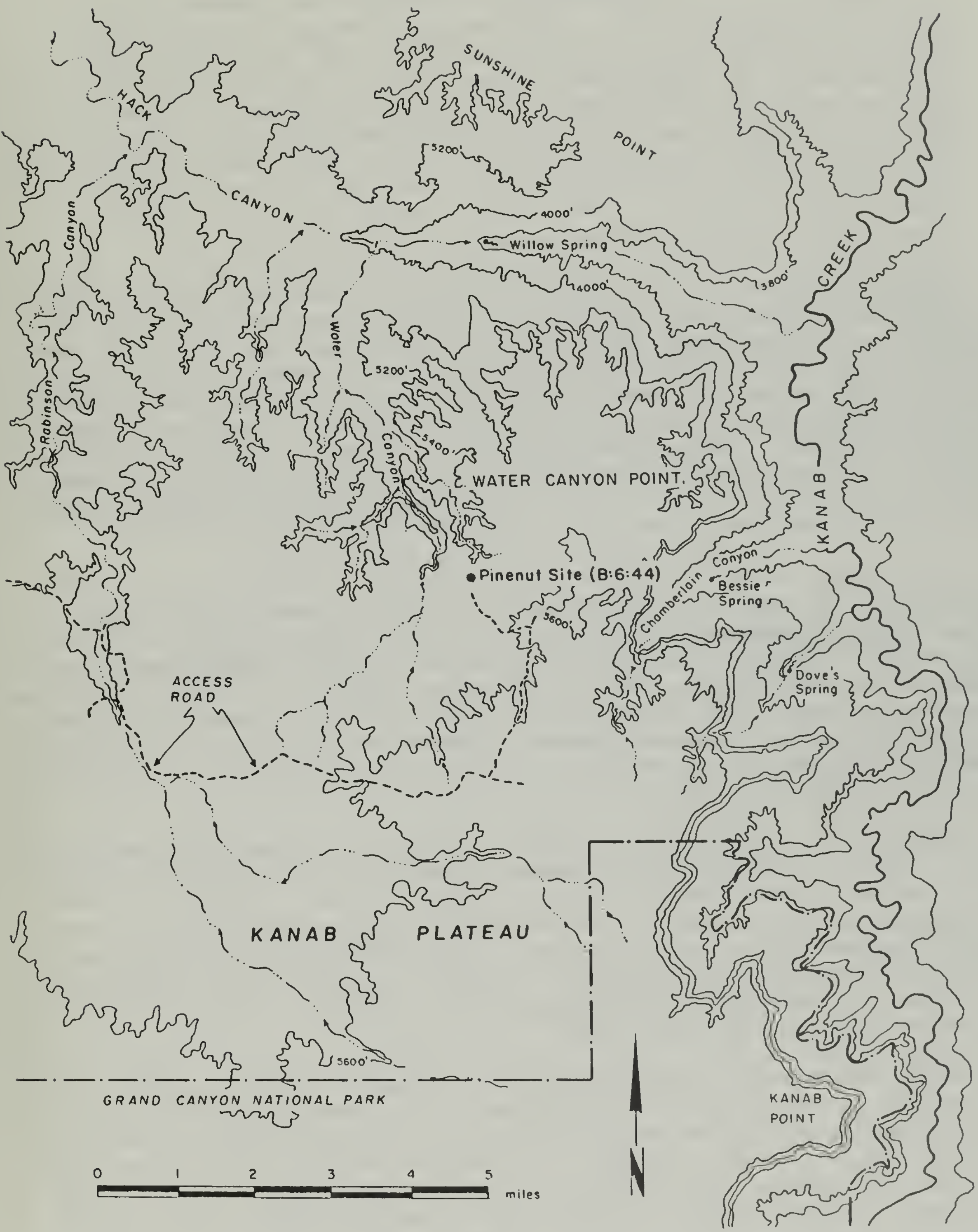


Figure 2.2. Pinenut Site Location Map.

> Snow to a depth of a few inches covers the lower lands intermittently during December, January, and February; on the higher lands it may fall any time between October and March and remain in sheltered places until April or May. Representative of considerable areas, 37 inches of snow have been measured at Nephi Ranch and 22 inches at Kanab. Unlike the water from rains, most of which rushes from the surface before it can percolate into the soil, that from melting snow soaks into the ground, thus feeding springs, giving sustenance to plants, and slowly pouring water into stream channels at the time when most needed for irrigation.

The vegetation of the Kanab Plateau has been altered by years of livestock grazing since the 1870s. At present, vast acres of sagebrush dominate the plateau where grass once grew stirrup-high as far as the eye could see (House 1986:23-26). The southerly reaches of the Kanab Plateau which border on lower Kanab Creek Canyon and the Grand Canyon North Rim, however, are distinguished by the presence of mature, pinyon-juniper woodlands. These occur primarily on ridges at elevations above 5000 ft. and are interspersed with sagebrush-filled shallow troughs, providing numerous ecotonal niches. The Pinenut Site on Water Canyon Point, at an elevation of 5440 ft., is located within such an ecotone.

The middle-range elevational attributes of Water Canyon Point allow for a diversity of plant species. Pinyon pine (*Pinus edulis*), juniper (*Juniperus monosperma*), broad-leaf yucca (*Yucca baccata*), prickly pear cactus (*Opuntia* sp.), and cliffrose (*Cowania stansburiana*) are common in the woodlands on ridges surrounding the site. Shallow troughs which occur between the ridges contain dense stands of sagebrush (*Artemisia tridentata*) and sparse grasses. Despite overgrazing of the grasslands, the density and maturity of the woodlands hint at relatively long-term forest stability.

The Arizona Strip supports numerous and varied animals (Hoffmeister 1971). Mammals include a wide range of small to medium-sized species and a few large game animals. Smaller mammals include cottontail rabbits (*Sylvilagus* sp.), black-tailed jackrabbits (*Lepus californicus*), and various chipmunks, squirrels, and mice. The large game species include mule deer (*Odocoileus hemionus*), pronghorn (*Antiocapra americana*), and bighorn sheep (*Ovis canadensis*). In addition, numerous species of avifauna and reptiles also occur.

It is important to note that the above overview reflects present-day environmental conditions and may vary from those of the prehistoric past. Such variation may have implications for interpreting the prehistoric occupation of Water Canyon Point and the Arizona Strip in general. Since no detailed studies of the paleoenvironment of the Arizona Strip have been conducted, data from surrounding regions will be extrapolated for the project area (Berry 1982; Dean et al. 1985; Euler et al. 1979).

Culture-Historical Context

Long isolated from the mainstream of archaeological research, the Arizona Strip has essentially been a blank spot on the map of the prehistoric Southwest. Previous research has been limited to surface surveys and a few excavation projects. Much of what is generally accepted as Arizona Strip prehistory has largely been pieced together from scanty archaeological evidence and from knowledge gained from research in peripheral areas.

It is important to note the geographical position of the Arizona Strip between the Grand Canyon North Rim and the Virgin River. Conventional wisdom views the Grand Canyon North Rim as the northeastern frontier of the Kayenta Anasazi cultural tradition, while the Virgin River drainage has long been considered the heartland of the Virgin Anasazi cultural tradition. Geographically situated between these two cultural spheres, the Arizona Strip may be considered as a broad interface zone where attributes of both the Kayenta and Virgin Anasazi traditions occur. For this reason it is useful to review research in both of these peripheral areas so that the cultural context of the Pinenut Site might be better understood.

Previous Research in the Arizona Strip

The first documented systematic archaeological survey was conducted in 1918 and 1920 by Neil Judd, who investigated Anasazi sites on the Paria, Kaibab, and Walhalla Plateaus, the area of Kanab, Utah, and portions of the Grand Canyon North Rim. During the late 1930s Julian Steward performed several surveys along the middle Paria River and along Johnson Canyon, Utah. Steward (1941) recorded numerous puebloan habitation sites, most of which were single-unit structures arranged in linear rows or semi-circular C-shapes. Farther to the southwest along the Muddy River in Nevada, Mark R. Harrington excavated Lost City, which came to be the "type site" for establishing the broad outlines of the Virgin Anasazi cultural tradition (Shutler 1961).

Subsequently, E.T. Hall (1942) conducted a survey of the Walhalla Plateau and recorded numerous sites. The results of Hall's work were later utilized by the School of American Research in a series of research projects designed to explore the various manifestations of the Anasazi cultural tradition in different microenvironmental settings on the Grand Canyon North Rim (Walhalla Plateau) and the inner canyon (Unkar Delta). These studies documented the establishment of Kayenta Anasazi agricultural settlements during the period A.D. 1050 to 1150 in both localities, with a substantial representation of Virgin Anasazi ceramics evident in the later temporal phases. The authors concluded that sites in the two contrasting settings represented seasonal occupations within a single general subsistence-settlement system based heavily on agriculture (Schwartz et al. 1980; Schwartz et al. 1981). Effland, Jones and Euler (1981) conducted a sample-oriented archaeological survey of the Powell Plateau about 30 miles west of the Walhalla Plateau.

The authors documented a number of agricultural settlements and water control features similar to those reported for the Walhalla Plateau. Ceramic cross-dating indicated these sites were also occupied primarily during the A.D. 1050 to 1150 interval.

Analysis of several variables indicated that the Powell Plateau was occupied during both the summer and winter months and that the prehistoric population was affiliated with the Kayenta Anasazi cultural tradition; the authors did not recognize Virgin Anasazi ceramics in their survey collections. These findings contrast with those of Schwartz and others (1981) who proposed that the Walhalla Plateau was occupied only during the summer months, and that there were indications of local manufacture of Virgin Anasazi pottery. While these two research projects were oriented toward elucidating the prehistory of the eastern section of the Grand Canyon North Rim, it should be noted that the Walhalla and Powell Plateau are also southward extensions of the massive Kaibab Plateau of the Arizona Strip. Abbott (1979) has compiled data from U.S. Forest Service cultural resource inventories on the Kaibab Plateau which reveal Archaic, Virgin Anasazi, and Southern Paiute occupation of the plateau interior. Here, Virgin Anasazi habitation sites most often occur in pinyon-juniper/ponderosa pine ecotonal areas, whereas the higher elevation ponderosa/mixed conifer zones exhibit a predominance of limited activity sites, thought to indicate an emphasis on hunting. Diagnostic ceramics indicated that the habitation sites were occupied by Virgin Anasazi groups during the A.D. 1000 to 1150 time span.

In 1977 the National Park Service sponsored a sample-oriented survey of lands adjacent to Grand Canyon National Park for a proposed expansion of the Park boundaries (Teague and McClellan 1978). Less than 1% of a total area of 730 miles covering the Kanab Plateau, the Shivwits Plateau, and Andrus, Parashant, and Whitmore Canyons was surveyed for cultural resources. The majority of 171 sites located during this survey were lithic scatters; the authors concluded that "agriculture was of little importance and that occupations were oriented to hunting, plant gathering, and procuring stone tools" (Teague and McClellan 1978:2).

The westernmost section of the Arizona Strip, including the Shivwits Plateau and the Grand Wash Cliffs, has only been minimally investigated. Previous surveys have generally documented Virgin Anasazi occupations during the late A.D. 1100s as well as more generalized late prehistoric resource procurement and processing activities (Holmer 1977; McClellan and Phillips 1978).

During 1972 to 1973, the Museum of Northern Arizona surveyed an electric transmission line segment from the Navajo Generating Station at Page, Arizona, to the Nevada border southwest of St. George, Utah. This transected the extreme northwestern edge of the Arizona Strip. The majority of the sites recorded in this section were small hunting and gathering sites of Virgin-Kayenta and Southern Paiute affiliation. This survey constitutes the single most substantial survey effort within the interior of the Arizona Strip.

More recently, Brigham Young University has been conducting on-going excavations and laboratory analyses of cultural materials from Antelope Cave (NA 5507), located on the Uinkaret Plateau (Janetski and Hall 1983). Preliminary indications are that the cave was occupied by Virgin Anasazi groups during the Basketmaker and Pueblo I-II periods. The material culture and subsistence data indicated that this was a residential site and the recovery of corn, beans, and squash macrofossils along with specimens of wild plants reflected a mixed horticultural and foraging subsistence base.

In 1986 and 1987, Abajo Archaeology conducted archaeological surveys along the right-of-way of a proposed ore haul road and electric powerline corridor on the southern Kanab Plateau (Westfall 1986b; Westfall and Davis, in preparation). The survey of the haul road documented 14 sites along the 22-mile long construction corridor and 10 additional sites along the ridges outside the corridor (data on file at the BLM Arizona Strip District Office, St. George, Utah). The majority of the sites are clustered around the headwaters of Water Canyon and consist of small habitation features, water control systems, limited activity sites, and one C-shaped pueblo. Diagnostic ceramics indicated the sites were occupied by Virgin Anasazi groups during the A.D. 1000 to 1150 time span, although several Kayenta Anasazi ceramics also were noted. The powerline corridor survey located 15 sites, the majority of which are clustered on a high ridge system between Water Canyon and Robinson Canyon, south of Hack Canyon. For the most part, these sites consist of Archaic base camps and lithic quarry/workshops, and one Virgin Anasazi habitation site was located along a segment of the corridor west of Water Canyon.

Lastly, mention should be made here of a large body of cultural resource inventory data on file at the BLM Arizona Strip District Office. Over 2500 sites have been recorded for various localities within the Arizona Strip (Jennifer Jack, personal communication 1987). These data, long unavailable, are in the process of being synthesized for an overview of the cultural resources of the Arizona Strip (Altschul and Fairley, in preparation).

Culture-Historical Overview

The Arizona Strip is situated at the interface of three significant physiographic features: the Colorado Plateau, the Great Basin, and the Grand Canyon of the Colorado River. This places the project area within the potential geographic range of several aboriginal cultures: the PaleoIndian, Archaic, Anasazi, Fremont, and Numic (Southern Paiute). Researchers have utilized a general culture-temporal framework as a heuristic device for organizing these synchronic cultural manifestations into a diachronic evolutionary framework: the PaleoIndian period (ca. 10,000 B.P. to 8,000 B.P.), the Archaic period (ca. 8,000 B.P. to ca. A.D. 1), the Formative period (ca. 300 B.C. to A.D. 1150/1200), and the Protohistoric period (ca. A.D. 1300 to ca. A.D. 1776). The Historic period began with the documented travels of the Spanish explorer Escalante through southern Utah and northwestern Arizona in A.D. 1776, continuing through the era of Mormon colonization and settlement from the 1850s to the early 1900s.

The PaleoIndian Period

The PaleoIndian big-game hunting tradition is known to have existed in western North America during the closing years of the Pleistocene epoch (ca. 12,000-9,000 B.P.). Well-defined environmental and cultural sequences have been developed for the PaleoIndian tradition on the High Plains (Frison 1978), the Lower Sonoran Desert (Haury et al. 1957), and the Great Basin (Davis and Shutler 1969); however, Pleistocene research on the Colorado Plateau is a relatively recent phenomenon. Research in the Grand Canyon has documented the presence of big-horn sheep, extinct mountain goat, giant ground sloth, camel, horse, and other artiodactyls (Long and Martin 1974; Robbins et al. 1984). At Bechan Cave in Glen Canyon, southern Utah, mammoth and giant ground sloth dung constitute additional evidence of big game species on the Colorado Plateau (Mead et al. 1984). Pollen and macrobotanical evidence from Stanton's Cave in Grand Canyon indicates a time of cooler or wetter conditions until approximately 10,800 B.P., when the climate began to change to approximately what it is today (Euler 1984).

Presence of PaleoIndian hunters on the southern Colorado Plateau has commonly been assumed on the basis of the occurrence of isolated, fluted projectile points in various localities in southern Utah. More substantial occupation has been documented recently at the Lime Ridge Clovis Site in San Juan County, Utah, and at the Montgomery Folsom Site on the Green River, central Utah (Davis 1985a, 1986). A single Clovis point found in Sullivan Canyon appears to constitute the sole evidence of PaleoIndian occupation in the Arizona Strip (Miller 1974).

The Archaic Period

The end of the PaleoIndian big-game hunting tradition is correlated with the shift to a gradual warming and drying trend at the close of the Pleistocene. Although the fate of PaleoIndian hunters is unknown, the archaeological record shows a gradual shift in subsistence orientation towards a more eclectic foraging strategy that focused on hunting small and large game mammals and gathering wild plant resources (Jennings 1978).

Archaic occupation of the Arizona Strip region has been documented at Rock Canyon Shelter near Antelope Cave in the vicinity of the Hurricane Cliffs on the Uinkaret Plateau (Dr. Joel Janetski, BYU, personal communication 1986), at the Kanab North Site on Middle Kanab Creek on the Kanab Plateau (Brown 1982), at a few open camp sites near Buckskin Gulch at the interface of the Kaibab and Paria Plateaus (Moffit et al. 1978), and on the Paria Plateau (Mueller et al. 1968). Dating of Archaic sites has relied primarily on diagnostic dart points: Gypsum, Pinto Basin Complex, and Elko Series, ranging from Early to Late Archaic. In addition to distinctive dart point technological complexes, the Split-Twig Figurine Complex represents another diagnostic Archaic trait, although its temporal relationship to specific projectile point complexes remains to be confirmed for the Arizona Strip-Grand Canyon region (Euler 1984; Euler and Olson 1965; McNutt and Euler 1966; Schroedl 1977).

Archaic adaptations in the Arizona Strip appear to conform to Jennings' Desert Culture model, involving a reliance on hunting and gathering, although not enough data are available to evaluate the relative importance of each activity. Present survey data indicate that Archaic groups may have favored some areas over others; for example, Archaic sites appear to be rare along the North Rim, (Effland et al. 1981:13) while they appear to be relatively better represented within the inner Grand Canyon and the interior plateaus of the Arizona Strip (Brown 1982; Moffit et al. 1978; Westfall and Davis, in preparation).

Assuming the existence of an Archaic subsistence system which was closely adjusted to the environment, the Archaic settlement pattern may reflect differential distribution of desirable food resources, conditioned by accessibility and cultural (territorial) factors. Moreover, evidence from elsewhere in the Southwest indicates that domesticates were present as early as 1900 B.C., and some scholars have suggested that Late Archaic groups could have practiced horticulture in addition to hunting and gathering. The question of subsistence emphases has important implications for evaluating prehistoric settlement patterning, since different environmental variables would condition site location with respect to a purely hunting-gathering strategy versus a mixed hunting-gathering-horticulture strategy. The problem has additional implications for addressing the Archaic/Formative interface; controversy exists over whether Formative cultures evolved from an Archaic base, or if Formative culture groups introduced intensive agricultural methods from elsewhere (Jennings 1978; Madsen and Berry 1978). Hence, description of material culture patterns, identification of Archaic settlement patterns, and identification of environmental variables are important problems that need to be addressed to understand the process of Archaic adaptations in the Arizona Strip. Over-arching these concerns is the continuing necessity to refine chronological and paleoenvironmental sequences. Local chronologies are just beginning to be established (Brown 1983; Euler 1984; Dr. Joel Janetski, BYU, personal communication); these and future studies are needed to develop a chronological sequence for the Archaic occupation to evaluate changing adaptational strategies through time.

The Formative Period

The rubric "Formative" is generally applied to cultural traditions in which horticulture was added to or supplanted the Archaic hunting and gathering subsistence base (Willey and Phillips 1958). Concomitant with this change in subsistence was the development of settled villages, the use of the bow and arrow in hunting, and the manufacture of ceramic vessels. Jennings (1978:155) attributes these changes to Mexican and Southwestern influences on Archaic groups, although others have argued that the Archaic peoples had abandoned the eastern Great Basin prior to Formative occupation (Madsen and Berry 1978). The fate of the Archaic, as well as the beginnings of the Formative cultures, on the southern Colorado plateaus continues to be an important research problem.

Within the Arizona Strip, Formative cultures include the Kayenta Anasazi, and the Virgin Anasazi. A third cultural group, the Fremont, is known to have established settlements to the north, on the Wasatch Plateau; however, Fremont interaction with Arizona Strip Anasazi groups appears to have been relatively limited, since the only Fremont diagnostics so far reported have been a few ceramic sherds.

Colton (1952) initially described the Virgin Anasazi as the "Virgin Branch of the Kayenta Anasazi," believing that ceramic types in the Virgin River drainage were derived from the Kayenta Anasazi ceramic tradition to the southeast. Colton recognized three distinctive ceramic wares for the Arizona Strip: Tusayan Gray Ware and White Ware: Virgin Series, Moapa Gray Ware and White Ware, and Shinarump Gray Ware and White Ware. These were ascribed to Virgin Anasazi manufacture and parallel trends in Virgin Series decorated ceramics with the Tsegi (or Kayenta) Series used to cross-date Virgin Anasazi sites.

Often, it is difficult to separate Virgin Series ceramics from the Kayenta Series ceramics (see Bond, Chapter 6, this volume), and the boundary between the Virgin and Kayenta Anasazi cultural areas is a subject of dispute. Thompson (1978) has suggested usage of the term "Western Anasazi" to accommodate manifestations of the Anasazi culture north and west of the Colorado River. In this report we have chosen to maintain a distinction between Virgin and Kayenta Anasazi nomenclature on the basis of ceramics, architecture, and geography.

The Virgin River drainage in extreme SW Utah, NW Arizona, and SE Nevada has traditionally been considered the heartland of the Virgin Anasazi cultural tradition. At its maximum extent, the Virgin Anasazi culture area extended north to the Zion Park uplands, east toward the Kaiparowits Plateau in Utah, south to the Colorado River in Arizona, and west-southwest along the Muddy River in Nevada. As such, the Virgin Anasazi territory encompassed a diverse range of environmental features that included high plateaus, basins, and canyonlands.

Early archaeological investigations at Virgin Anasazi sites include the Lost City area on the Muddy River in Nevada (Shutler 1961), and several sites in southwestern Utah by the University of Utah (Aikens 1965, 1966). These investigations formed the basic groundwork for the definition of the Virgin Anasazi tradition, which was generally believed to have paralleled developments in the Kayenta Anasazi region to the southeast.

Shutler (1961) developed a basic chronology for the Virgin Anasazi tradition based primarily on analogs with dated Kayenta Anasazi ceramics: the Moapa Phase (Basketmaker II: 300 B.C.-A.D. 500), the Muddy River Phase (Basketmaker III: A.D. 500-700), the Lost City Phase (Pueblo I-II: A.D. 700-1100), and the Mesa House Phase (Pueblo III: A.D. 1100-1150). More recently, investigators in southwest Utah and in the Arizona Strip have questioned the applicability of the Lost City Phase sequence to Virgin Anasazi sites at large. Moreover, it has been difficult to apply the Pecos Classification temporal scheme to the Virgin Anasazi culture area particularly with respect to ceramic cross-dating (Walling et al. 1986; Wilson 1985). Hence, research emphases have shifted towards developing local chronologies appropriate to the locality under study, resulting in greater refinement of the general chronology (Dalley and McFadden 1985; Janetski and Hall 1983; Nickens and Kvamme 1981; Westfall 1985a).

Through time, Virgin Anasazi settlements along the Virgin and Muddy Rivers evolved from randomly organized pit house villages to increasingly nucleated pueblo towns, generally thought to be dependent on an agricultural subsistence base (Aikens 1965, 1966; Dalley and McFadden 1985; Shutler 1961). Elsewhere, however, investigations in the hinterlands of southern Utah, the Arizona Strip plateaus, and along the Grand Canyon North Rim have contributed information about small, special-use sites, seasonal horticultural hamlets, and large settlements apparently not dependent on intensive agriculture, but instead reflecting an eclectic foraging subsistence strategy that incorporated hunting, gathering, and horticulture (Janetski and Hall 1983; Jones 1986; Metcalf 1981; Moffit and Chang 1978; Moffit et al. 1978; Nickens and Kvamme 1981; Thompson 1970; Westfall and Davis, in preparation).

Sites investigated on the Arizona Strip plateaus have generally been subsumed under the Virgin Anasazi tradition, although researchers working in the Grand Canyon and along the North Rim report a greater incidence of Kayenta Anasazi affiliation (Effland et al. 1981; Jones 1986; Schwartz et al. 1981). By and large, researchers have generally assumed that differences in ceramics indicate cultural differences beyond material culture. Certain wares, such as Shinarump and Moapa are usually associated with Virgin Anasazi manufacture. However, distinctions between the Virgin series and Kayenta series of Tusayan Gray Ware and White Ware are not so obvious in many cases, particularly along the eastern interface of the Arizona Strip plateaus and the Grand Canyon North Rim (Effland et al. 1981; Schwartz 1969; Wilson 1985).

Present indications are that some settlements were established on the Arizona Strip plateaus as early as A.D. 520±120 (Nickens and Kvamme 1981), although the majority of current evidence indicates the beginning of sustained use of the hinterlands around A.D. 700 to 800 (Effland et al. 1981:13; Westfall 1985). Population expansion appears to have evolved slowly during A.D. 900 to 1000 (Pueblo I). Beginning around A.D. 1050 (Pueblo I-II) increased site densities occur in relatively high-altitude settings such as Mt. Trumbull, Little Creek Mountain, and the Grand Canyon North Rim (Effland et al. 1981; Moffit and Chang 1978; Thompson 1970; Wise 1986) during the period A.D. 1050 to 1150, but by A.D. 1150, the Arizona Strip hinterlands, the Grand Canyon North Rim, and the Virgin River drainage system had largely been abandoned, although remnant populations survived on Mt. Trumbull and in the Lost City area up to A.D. 1200/1225. Gunnerson (1962) has suggested that deteriorating agricultural conditions forced the Virgin Anasazi to return southeast to the Kayenta homeland. Others, arguing that late Virgin Anasazi traits are absent in the Kayenta region to support this assumption, suggest that Southern Paiute bands, who were better equipped to survive conditions of environmental stress, may have successfully competed for scarce resources, ultimately hastening the demise of the Virgin Anasazi (Aikens 1970; Berry 1982; Euler 1964; Madsen 1975; Thompson and Thompson 1982).

The issue of abandonment is a controversial subject. Berry (1982) has argued that widespread abandonments and migrations in the Southwest occurred in response to periodic Plateau-wide droughts during the transitional phases of the Basketmaker and Puebloan temporal sequence. These droughts are thought to have caused abandonment of low-elevation localities and migration to high-elevation refuge sites (refugia). In another vein, Euler and others (1978) and Dean and others (1985) have developed a testable general paleoenvironmental model to account for behavioral variability in the prehistoric record for the Colorado Plateau. The authors utilize several lines of evidence developed from studies of prehistoric hydrology, dendroclimate, dendrochronology, and demography to argue for a number of different adaptive responses to paleoenvironmental change. While this model will be explored in greater detail in the next chapter, it will suffice to say here that there is compelling evidence to demonstrate a general abandonment of the region around A.D. 1150 in response to general drought conditions. However, there is also evidence that certain Anasazi groups remained on the Grand Canyon North Rim, the inner Grand Canyon, and along the Virgin River drainage well into the thirteenth century (Jones 1985; Thompson and Thompson 1974; Walling et al. 1986).

The Protohistoric Period

The Protohistoric period generally applies to the time of the entry of Uto-Aztecan Numic-speaking groups into the Southwest and extending to the time of the Spanish explorers in A.D. 1776. Within the Arizona Strip certain Numic bands, later to become known as the Southern Paiute, are believed to have come into the area sometime during the period A.D. 1050 to 1150, based on the co-occurrence of Virgin Anasazi and Southern Paiute ceramics in several stratigraphic contexts (Euler 1964; Fowler and Fowler 1981; Shutler 1961; Shutler and others 1960).

The Southern Paiute were essentially semi-nomadic hunter-gatherers, adapted to a lifeway of seasonal transhumance across a broad elevational range that encompassed basin and range, high plateaus, and canyonlands (Euler 1966; Kelly 1964; Fowler 1966). Their territory essentially overlapped that of the Virgin and northern Kayenta Anasazi. The Southern Paiute generally followed an annual subsistence round. In the autumn, groups moved up onto the plateaus to collect pinyon nuts and yucca fruit, and to hunt deer. Stores were cached for the winter, but ordinarily winter and early spring could be times of near-famine unless trips were made to the rim of the Colorado River to gather cacti, mescal, and juniper berries. In summer, groups returned to springs and other perennial water sources at the foot of the plateaus and there gathered seeds, berries, greens, and roots. Small game constituted the principal source of meat throughout the year; specialized hunting groups would range out for larger game such as mule deer, mountain sheep, and antelope (Kelly 1964).

Several scholars have suggested that the Southern Paiute may have learned horticultural methods from the Virgin Anasazi (Euler 1964; Fowler and Fowler 1981; Fowler et al. 1973). The subject has been debated for several years, but to no conclusion. At any rate, the practice of horticulture distinguishes the Southern Paiute from the other, more northerly Ute bands of the Great Basin. Ditch irrigation was utilized by the more westerly bands along the Virgin, Santa Clara, and Muddy Rivers, while the easterly bands (e.g., Kaibab Paiute) situated small farm plots near seeps and springs (Euler 1966; Kelly 1964). Ethnohistoric sources cite several instances where the Spanish explorers of the period A.D. 1776 to 1777 described the cultivation of corn and squash by Southern Paiutes, and also mentioned trade (Euler 1966:111-113). Trade would have been a necessary component of a transhumant lifeway in order to ensure adequate provender for groups lacking direct access to desirable resources (e.g., exchange of domesticated foodstuffs for gathered wild food items).

As befitting a semi-nomadic lifeway, Southern Paiute material culture was relatively basic, simple, and portable. Euler (1966:114) has commented that the chronological sequence from 1776 to the late 1870s reveals that Southern Paiute material culture items remained fairly stable. These include conical-bottomed plain brownware pottery vessels sometimes decorated with fingernail incision, basketry for hats and containers, rabbit fur robes, rabbit nets, bows and arrows, woven mats and bags, animal hide clothing, digging sticks, milling stones, and various expedient stone tools. Through trade, the Southern Paiute obtained turquoise from the Hopi, buffalo robes from the northern Utes, and cloth and tools from the Anglo-Americans.

Southern Paiute settlements generally consisted of several wickiups constructed of bent willow and cottonwood branches, overlain with brush or juniper branches (depending on the locality). At least one reference is made of Paiutes occupying "crevices" or rockshelters by Father de Smet in 1841 (Euler 1966:114).

Archaeological study of Southern Paiute sites has been limited to a few localities peripheral to the Arizona Strip (McClellan and Phillips 1978; Moffit et al. 1978; Walling et al. 1986; Westfall 1985; Westfall et al. in press). Collectively, these investigations have substantiated the ethnographic record and have allowed refinement of Southern Paiute temporal and demographic trends prior to and including the post-contact historic period.

CHAPTER III

RESEARCH DESIGN

Theoretical Perspective

The culture-historical overview summarized in Chapter II reflects the culmination of several decades of research, whereby archaeologists have used material culture variation to determine time-space systematics for the prehistoric occupation of the Arizona Strip. These views are intimately linked with broader generalizations about the prehistoric Anasazi of the Southwest, which portray the Anasazi as essentially sedentary agriculturalists who lived in economically and organizationally autonomous villages. Through time, as the population increased, villages increased in size, the degree of reliance on agriculture increased, and intravillage organization became more complex. Systemic collapse and abandonment occurred as a result of a combination of negative ecological and cultural factors (Aikens 1966; Jennings 1966; Lipe 1978; Lipe and Thompson 1978; Martin and Plog 1973; Shutler 1961).

The cultural-evolutionary model of culture change holds the view that the adoption and maintenance of an agricultural subsistence base functioned as a "prime mover" resulting in rapid population growth, technological innovation, and the formation of complex societies. As such, it reflects a philosophical bias toward a normative view of cultural evolutionary theory, which assumes fixed behavioral responses to environmental and social conditions conducive to an agricultural subsistence base (Cordell and Plog 1979). Under the conditions of such a model, small sites such as the Pinenut Site are viewed as occupying an intermediate position on a hierarchical continuum of organizational complexity, demographic scale, and geographic extent. Small, randomly-organized pit house villages are represented at the lower end and large, complex pueblo towns at the upper end of the evolutionary spectrum. Powell (1983:52) has since pointed out that such a view of Anasazi cultural evolution developed as a result of empirical generalizations derived from ethnographic analogy, the early emphases on excavation of large complex villages, and excavation of sheltered sites with their well-preserved organic remains such as corn.

More recent research in the Southwest has contributed new information showing that the prehistoric Anasazi used a number of different subsistence strategies other than intensive agriculture as adaptational responses to different environmental conditions. Palynological, plant macrofossil, faunal, and geomorphic studies have provided relevant paleoenvironmental data as well as substantive information about prehistoric diet. In conjunction with studies of material culture patterns and site distribution, archaeologists have greatly increased our knowledge about the role of small sites in the context of cultural systems. These studies show that, given the record of extreme variability and unpredictability of environmental conditions on the southern Colorado

Plateaus, it seems unlikely that a sedentary, agriculturally-based lifeway could have been maintained throughout the Anasazi cultural sequence (Dean et al. 1985; Euler et al. 1979). Rather, a growing body of evidence appears to support the hypothesis that the Anasazi availed themselves of a variety of adaptive responses, including a dual or mixed dependence on hunted and gathered resources and on cultigens (Davis 1985b; Dean et al. 1985; Nickens and Kvamme 1981; Powell 1983; Westfall 1985a).

Powell (1983) has proposed a subsistence-settlement model for the Kayenta Anasazi of Black Mesa in northeastern Arizona. This model predicted behavioral variety under conditions of environmental variability and unpredictability. Specifically, "movement of people to resources was predicted when resources were unpredictable in annual yield or were spatially discontinuous" (Powell 1983:130). The archaeological data from a sample of small sites were tested against ethnographic Navajo subsistence-settlement data to develop a model of seasonal land use. Powell concluded that the Black Mesa Anasazi were never fully sedentary. Rather, in order to procure the foods necessary for survival, a seasonal round with shifting habitation site locations may have been the most appropriate adaptive response to environmental uncertainty. Diversification of the resource base, rather than agricultural intensification appears to have characterized Kayenta Anasazi culture change on Black Mesa up to the time of abandonment around A.D. 1150 (Powell 1983:130).

In the Northern San Juan Anasazi region of southeastern Utah, numerous researchers have argued that Basketmaker III peoples were subsisting on cultigens, practicing a sedentary settlement pattern, and living in politically autonomous villages. As the population expanded during the Pueblo II period, villages increased in number and size along with an increasing reliance on agriculture (Casjens et al. 1980; Lindsay 1981; Lindsay and Dykman 1981; Matson and Lipe 1978; Nielson et al. 1985). On the other hand, excavations at a series of small sites on White Mesa, Utah, have produced information indicating a different subsistence-settlement pattern (Davis 1985b). The evaluation of botanical and faunal data in conjunction with material culture and architectural studies determined that initially, Basketmaker III groups occupied semi-permanent homesteads and practiced a mixed subsistence strategy which included hunting, gathering, and horticulture. During the Pueblo II period, an even more diversified resource base is indicated by the botanical data, and sites occupied during this time exhibit relatively short-term, specialized use. Resources gathered, harvested, and processed at these sites may have been transported to larger settlements located elsewhere in the vicinity (Davis 1985b). More recently, through the application of carbon isotope analyses on prehistoric Anasazi burials, Matson and Chisholm (1986) have demonstrated that Anasazi groups on Cedar Mesa, Utah, were farming at relatively the same intensity from the Basketmaker II through the Pueblo II time span, and that gathered wild resources constituted an important part of the subsistence base.

Thus, on Cedar Mesa, as on White Mesa, subsistence diversification rather than agricultural intensification seems to have been the adaptational strategy implemented by mesa-top dwellers in response to environmental fluctuations in the Northern San Juan Anasazi region. These findings are consistent with Powell's (1983) conclusions about Kayenta Anasazi adaptational strategies on Black Mesa for the same time period.

In the Grand Canyon region bordering the Arizona Strip on the south, Schwartz and others (1980, 1981) have characterized the Kayenta Anasazi adaptational strategy during the A.D. 1050 to 1150 interval (Pueblo I-Pueblo II) as one based on seasonal movement between agricultural settlements located on the Grand Canyon North Rim (e.g., the Walhalla Plateau) and within the Inner Canyon (e.g., Unkar Delta). On the Powell Plateau, Effland and others (1981) have accumulated evidence showing that Kayenta Anasazi groups also may have occupied the Grand Canyon North Rim on a year-round basis, moving between seasonal summer farmsteads and larger winter settlements within the geographical constraints of the plateau. By A.D. 1150, probably in response to drought conditions, the Kayenta Anasazi had largely abandoned the Grand Canyon region save for a few groups who may have remained up to about A.D. 1225 (Jones 1986).

Within the Virgin Anasazi region, most researchers have described the Virgin Anasazi as essentially sedentary agriculturalists (Aikens 1966; Dalley and McFadden 1985; Lipe and Thompson 1978; Shutler 1961). Others, pointing out the occurrence of dispersed, small, special-use and short-term habitation sites on the Arizona Strip plateaus have argued for a mixed subsistence strategy (Moffit et al. 1978; Moffit and Chang 1978; Scott 1981; Teague and McClellan 1978; Westfall 1985a). Thompson and Thompson (1982) have suggested that the Virgin Anasazi practiced a predominantly horticultural strategy, and follow Berry (1974) in proposing that the Virgin Anasazi were forced into a predominantly foraging strategy in the face of deteriorating agricultural conditions toward the end of the prehistoric occupation.

Water Canyon Point, on which the Pinenut Site is located, can be viewed as being geographically situated on the southern frontier of the Arizona Strip region, or as an extension of the Grand Canyon North Rim. This situation places the Pinenut Site at the interface of the Virgin Anasazi and Kayenta Anasazi cultural spheres. It has been assumed that the Pinenut Site inhabitants were affiliated with the Virgin Anasazi cultural tradition on the basis of diagnostic ceramics and architectural features (Westfall 1985b); however, the location of the site with respect to the prehistoric settlement pattern on Water Canyon Point varies, of course, with the normative pattern of Virgin Anasazi riverine settlement. Even so, it is similar in several respects to Kayenta Anasazi site distributions reported for the Walhalla and Powell Plateaus to the east across Kanab Creek Canyon.

Given these observed variations in site location, ceramics, and architecture, it appears that the Pinenut Site was occupied by different groups re-visiting the site over time, or by a single cultural group who may have integrated systemic attributes of both the Virgin and Kayenta Anasazi cultural traditions. If the settlement of Water Canyon Point occurred in response to certain environmental and cultural stimuli, paleoenvironmental and material culture data from the Pinenut Site and survey data from Water Canyon Point should provide answers to specific questions about logistical and behavioral responses made by the site inhabitants to these stimuli. Chronological data can organize these events in time. The results of this study can then be compared to existing models of Anasazi adaptations in the Arizona Strip region. As well, the data can also be used as an independent test of general theoretical models concerning local adaptations to regional paleoenvironmental and cultural events in northwestern Arizona.

Research Problem Domains

The major research focus of this study is to evaluate the function and role of the Pinenut Site in the context of Anasazi adaptational strategies on Water Canyon Point. The study will be organized to address hypotheses concerning specific logistical and behavioral responses made by the inhabitants to environmental and cultural factors. The kinds of data needed to address these hypotheses are subsumed under five general problem domains: Chronology, Environment, Subsistence, Technology, and Logistical Organization.

Chronology

Chronological data are essential for monitoring change in environmental conditions, subsistence strategies, and technological adaptations in material cultural assemblages. Few absolute dates are available for the Anasazi occupation of the Arizona Strip due to the paucity of excavated sites, and ceramic cross-dating is debated among scholars, particularly when temporally-sensitive Kayenta Anasazi design styles are used to cross-date Virgin Anasazi ceramic assemblages.

Ceramic cross-dating was used to infer a Pueblo I-II occupation of the Pinenut Site (Westfall 1985b). It was felt that the site was established some time during the early Pueblo II period of population expansion in the Arizona Strip region. This temporal interval is also marked by a population growth peak during A.D. 1050 to 1150 in the Grand Canyon (Effland et al. 1981; Jones 1986; Schwartz et al. 1981). The A.D. 1050 to 1150 interval is characterized by relatively salubrious climatic condition which may have stimulated population expansion into new environmental niches. Such may explain how the Pinenut Site was initially settled.

Special emphasis was placed on obtaining absolute dendrochronological and radiocarbon dates for the Pinenut Site. These will be used to order material culture patterns in time and to contribute useful data concerning the temporal lifespans of diagnostic ceramics in the Arizona Strip region.

Environment

Prehistoric adaptational strategies are predicated on the necessity to obtain food for survival. Consequently, the natural environment of the Pinenut Site will be investigated to identify the climatic regime, target resources, and accessibility to resource areas that facilitated human settlement of Water Canyon Point.

Paleoenvironmental studies for the southern Colorado Plateaus have shown that prehistoric climatic oscillations were common (Dean et al. 1985; Euler et al. 1979). The period A.D. 700 to 1050 was a time of high temporal climatic variability, which reduced the predictability of precipitation, and thus may have stimulated exploitation and settlement of new resource areas (Dean et al. 1985:543). Around A.D. 900, conditions returned to a period of floodplain aggradation and rising water tables. These improved hydrologic conditions may have mitigated the effects of unpredictable precipitation, because groundwater storage integrates heavy precipitation into a more persistent hydrologic system. A more persistent precipitation regime returned after A.D. 1000 to augment the favorable hydrologic conditions (Dean et al 1985:543). The A.D. 1050 to 1150 interval was characterized by high spatial variability in climatic conditions and a generally salubrious environment. High variability in climatic conditions is thought to have stimulated increased interaction among population groups to offset lower productive yields in less favorable areas. During A.D. 1150 to 1200 a major drought occurred, although a return to stream aggradation and high water tables alleviated the generally low precipitation regime. These stable hydrologic conditions prevailed until A.D. 1275, the time of the Great Drought, when extremely dry conditions, falling water tables, and rapidly expanding arroyo systems forced abandonment of densely populated areas (Dean et al. 1985:544).

Water Canyon Point is characterized by two significant environmental features unique to the Kanab Plateau. First, the headwater drainages described in Chapter II, function to collect precipitation from a broad, gently-sloping topography. The occurrence of water control features near some of these headwaters clearly demonstrates the feasibility of prehistoric dry-land farming techniques. Second, the existence of the several accessible springs would have provided the inhabitants with a reliable source of water during periods of low precipitation not conducive to horticulture (Jennifer Jack, BLM Arizona Strip District: personal communication 1987). Favorable hydrologic conditions may have allowed the continued growth and maintenance of wild plant and animal resources as well.

Evaluation of the prehistoric natural environment will be accomplished through the recovery and analysis of pollen, plant macrofloral, and faunal remains from the Pinenut Site. These will enable us to identify climatic trends and target resources that were exploited by the site inhabitants (see Subsistence, below). Resource areas will be identified through comparison with published literature on the occurrence and distribution of relevant floral and faunal species. These data will then be compared to existing archaeological data to evaluate the relationship of site location to accessible resource areas.

Subsistence

Normative models about prehistoric subsistence hold that the Virgin Anasazi were primarily agriculturalists who established permanent villages along major streams (Aikens 1966; Shutler 1961). Other interpretations have proposed a mixed subsistence pattern, which incorporated both horticultural and wild resource procurement strategies (Moffit and Chang 1978; Moffit and others 1978; Nickens and Kvamme 1981; Westfall 1985b; Westfall et al. in press).

Determining the subsistence base of the site inhabitants is critical to the proposed study, since the orientation of subsistence activities conditions occupational permanence (e.g., seasonal short-term use vs. long-term year-round occupation). In this case, we need to know if the Pinenut Site reflects a dependence on sedentary agriculture (implying semi-permanent occupation) or if the inhabitants incorporated an eclectic, mixed subsistence base (implying seasonal short-term occupations). If the pueblo room block at the site consists of storage rooms, were domesticated or wild resources stored there? Was surplus food consumed at the site (implying storage for long-term habitation), or was food transported and redistributed at other settlements (implying short-term seasonally repeated occupations)?

Determining the nature of target resources is critical to evaluating prehistoric subsistence strategies. We expect to accomplish this by detailed plant, pollen, and macrofloral studies and by analyses of faunal bone, as explained below.

Floral Resources

The kinds of plant species procured by the prehistoric inhabitants will be identified by pollen and plant macrofloral analyses. The relative different frequencies of varying species reflected in the paleobotanical record should provide substantive information about selective emphases on domesticated and wild resources. These data also will be used to evaluate occupational permanence as it relates to the subsistence strategy. If the Pinenut Site was occupied by a group engaged in sedentary horticulture, then a relatively narrow range of wild plant species should be represented, since stored agricultural surplus (e.g., corn) would have constituted a greater proportion of the prehistoric diet. Alternatively, if the site was occupied as a seasonal farmstead, evidence should exist for a relatively broad range of wild plant species, since these would have compensated for less agricultural surplus and also would have sustained the people during the crop-growing season.

The controlled recovery and analysis of pollen and macrofloral (flotation) samples from the floors of the pit structure, the room block, and the trash midden is expected to yield substantive information about prehistoric dietary emphases. Pollen washes from grinding implements should provide information on the kinds of resources that were processed for on-site consumption.

Faunal Resources

Many species of game animals are distributed throughout the diverse microenvironments of the Arizona Strip. Indeed, archaeological surveys in the region have documented numerous hunting camps and isolated projectile points. Previous work at the Kanab Site, near upper Kanab Creek, recovered a substantial assemblage of faunal bone. The faunal material was dominated by artiodactyls and rabbits, with domesticated turkey, sandhill crane, and Gambel's quail also present. Among the artiodactyl remains, the high frequency of foot bones of pronghorn, deer, and bighorn sheep indicated that these animals were primarily butchered at another location, with only the leg bones, skins, and stripped meat brought back to the site. Small mammals and the sandhill crane could have been attracted to agricultural fields (Emslie 1981:120-123).

With respect to faunal resources, then, did the Pinenut Site inhabitants practice hunting on a seasonal or year-round basis? Were local game animals hunted, or is there evidence of long-distance hunting? Do different relative frequencies of different species indicate selective emphases, if any? The presence of low meat-yield body parts could substantiate the local availability of faunal resources. Contrary data, such as the absence of artiodactyl skulls or distal limb bones which could be discarded in the field to lighten the carrying load, could indicate if there was any great distance involved.

Game processing methods and degrees of temporal variability will be examined by performing a rigorous attribute analysis of the degree of edge damage present on tools. It is expected that the processing of small game would result in the use of expedient informal flake tools which exhibit minimal edge damage. The processing of large game should be reflected by the presence of a hunter's formal tool kit with a variety of cutting, scraping, pounding, and mashing implements, all of which should exhibit varying degrees of edge abrasion/damage. In addition, different processing facilities and techniques should be revealed in fire hearth morphology and actual bone breakage patterning.

Other related goals in the study of faunal resources include how these were consumed (e.g., for food, tools, clothing, or ceremonial purposes), and identifying patterns of discard (e.g., what seasonal patterns of faunal discard are evident).

Technology

Technology includes the construction of dwellings and storage features and the manufacture and use of tools by prehistoric groups. A major assumption in material culture studies is that "the spatial patterning of archaeological remains reflects the spatial patterning of past behavior" (S. Plog 1978:148). While most archaeologists agree that behavioral variability is reflected in the material culture record, it must be recognized that multiple behavioral and natural processes form this record. In order to identify these processes, careful recovery of data is necessary for an appropriate reconstruction of past behavior patterns.

Architecture

The construction, location, and function of different site features all provide information about the relative permanence of occupation. The presence of substantial storage features generally indicates storage of surplus, which could be stored either for consumption over a long period of occupation or temporarily for transport and redistribution elsewhere. Under conditions of a horticulturally-based, semi-permanent occupation, it is expected that a greater quantity of agricultural produce would have been stored. Given the model of alternative subsistence strategies, a variety of domesticated and wild resources may have been stored along with agricultural surplus. Different emphases should be reflected in the pollen spectra from individual storage features.

Domestic architectural attributes are useful for evaluating occupational intensity. On the Walhalla Plateau survey Effland and others (1981) used room size as an index of occupational intensity; sites with small rooms were interpreted as seasonal summer farmsteads, while sites with larger rooms were thought to represent winter settlements. Similar indices of room size will be utilized to investigate the function of rooms at the Pinenut Site; these data should also aid in interpreting the function of other unexcavated sites on Water Canyon Point. In addition, the excavation of the Pinenut Site should reveal whether the rooms were constructed of durable masonry walls or if they were enclosed by a more light-duty wattle-and-daub superstructure. The former would indicate long-term habitation, while the latter would more likely characterize a seasonal summer occupation.

The occurrence, type, and frequency of small features, such as fire hearths, mealing bins, ramadas, and the like should provide information about seasonality of use. For instance, summer occupation would be indicated by a variety of exterior task areas, whereas fall and winter occupation would be indicated by a relatively larger proportion of protected, interior space (Powell 1983:75).

Lithic Technology

Chipped Stone Artifacts

The analysis of chipped stone artifacts from the Pinenut Site will focus on identifying tool kits associated with either a horticulturally-based subsistence strategy or a mixed subsistence strategy. A second goal will be to determine if the lithic tool assemblages indicates long-term occupation, or a series of repeated, seasonal, short-term occupations. The characterization of lithic manufacturing tool kits, resource procurement tool kits, and processing tool kits will aid in determining the functions carried out at the site.

It is expected that the quantity and diversity of artifact types will be directly related to site function. Long-term habitation sites are the locations of tool manufacture and maintenance, resource accumulation, resource processing, and storage. Seasonally-occupied special-use sites, on the other hand, should contain lithic assemblages indicative of fewer specialized activities. Long-term habitation sites should have more accumulated broken and worn-out lithic remains and exhibit a wider range of tool types than seasonally-occupied special-use sites.

Resource availability of lithic raw material types will be explored through site assemblage examination. The Pinenut Site lithic assemblage includes a variety of different colored cherts and quartzite. Most of the cherts appear to be derived from local exposures in outcrops of Kaibab Limestone that are common throughout the area. Other raw material types might have been obtained through trade and exchange.

Ground Stone Artifacts

Observable differences in the grinding tool kits of prehistoric populations generally fall into two basic categories: those associated with intensive corn-grinding assumed for agricultural subsistence strategies, and those associated with collecting strategies. In the former, commonly associated with Anasazi villages, the grinding tool kit usually includes two-hand manos and flat and troughed metates, with a low incidence of one-hand manos and basin metates. In the latter, one-hand manos are more common, implying greater portability, and metates are either flat unprepared grinding slabs or basin metates associated with seed-grinding. Thus, distinctive manos and milling stones occurring in site assemblages can yield information relevant to addressing several pertinent research problems.

The presence of grinding implements on a site, of course, indicates that plant and/or faunal and mineral resources (e.g., ceramic clays) were processed at the locality. Pollen analyses of sediments washed from the grinding surfaces of manos and milling stones can aid in determining what specific plants were processed. Clusterings of grinding implements may indicate task-specific milling areas, thus helping to identify intra-site functional variation. Correlation of functionally distinct grinding tool kits with chronological data may yield information about temporal and functional change in resource procurement and processing methods.

Ceramics

Ceramic sherds occur in moderate abundance in the trash midden at the Pinenut Site. The ceramic types include both utility wares and decorated types, implying a range of vessel functions. Also notable is the technological range indicated by the Virgin Series graywares and whitewares and by Moapa Gray Ware sherds.

Ceramics are commonly used to infer temporal and cultural affiliations of archaeological sites. However, researchers in Arizona Strip and Grand Canyon archaeology agree that the current ceramic typology is in need of a major reassessment, due to the increasing awareness that different temper and paste constituents among types may indicate locally distinctive ceramic manufacturing technologies. For example, in the Vermilion Cliffs Project area, east of Kanab, Utah, Dean Wilson (1985) identified local production of Shinarump Wares and importation of non-local Virgin-Kayenta ceramics. The conclusion of this study is that local groups participated in an exchange system with groups from other areas (Westfall 1985b:194).

The proposed analysis of ceramics will stress a rigorous attribute analysis that will yield substantive answers to questions about Virgin Anasazi ceramic manufacturing technologies, and how the occurrence of different wares at the site reflect trade and exchange systems. Analyses of vessel form, function, and frequency of occurrence should inform on the kinds of subsistence-related tasks that were carried out at the site (e.g., storage, cooking, or ceremonial).

Study of the distribution of artifacts with respect to architectural features should yield information on the spatial organization of subsistence-related activities. From these we can infer the logistical organization of tasks conducted at the site in order to evaluate site function.

Logistical Organization

The prehistoric occupation of the Arizona Strip has been characterized by different subsistence strategies that included varying emphases on horticulture, hunting, and gathering. Important research issues concern the relative degree of reliance on these different components of a subsistence base and how groups were logistically organized into an annual round of subsistence-related behavior.

Previous research has characterized the Arizona Strip and the Grand Canyon North Rim as marginal for horticulture (Effland et al. 1985; Lipe and Thompson 1978; Schwartz et al. 1981). Schwartz and others have argued that the Walhalla Plateau was occupied by Kayenta Anasazi groups during the summer season and that these groups migrated to inner canyon settlements for the winter. Biseasonal population movement also may have been practiced by Kayenta Anasazi groups on the Powell Plateau, although the presence of several large habitation structures on the plateau suggests that some groups may have remained there through the winter (Effland et al. 1985:42-43).

Survey data on Water Canyon Point show that dry-land farming was possible by means of water control systems such as serial check dams and terraces (Westfall 1986b; data on file at BLM Arizona Strip District Office, St. George, Utah). Climatic data summarized by Gregory (1948; see Chapter II, this volume) shows that for elevations between 4500 ft. and 5500 ft. on the Arizona Strip the average growing season is an ample 151 days. Winter precipitation during January, February, and March which melts slowly during April, May, and June is critical for present-day irrigation farming. Summer rainfall is erratic and more often rushes off before absorbing into the soil. If similar climatic conditions prevailed on Water Canyon Point during the Anasazi occupation, the prehistoric water control systems may have functioned to impound and control snowmelt during the critical spring planting time, and to channel summer rainfall runoff as well. However, unlike Virgin Anasazi riverine settlements which were assured of a relatively steady water supply, the seasonal precipitation regime and localized character of summer rainfall on the Arizona Strip plateaus created a relatively high risk for farming. The Grand Canyon North Rim also has been characterized as marginal for agriculture and water control systems have been documented on both the Walhalla and Powell Plateaus (Effland et al. 1987:42; Schwartz et al. 1981).

Given these conditions of marginality and risk, a number of different adaptive strategies would have been implemented to ensure group survival on Water Canyon Point. Current theoretical literature has developed general models and archaeological expectations for predicting different behavioral responses to factors affecting the subsistence base (Berry 1982; Binford 1980, 1982; Dean et al. 1985; Effland, Jones, and Euler 1981; Powell 1983). These are based on material culture correlates of specific kinds of prehistoric behavior, interpreted as adaptive mechanics to environmental and cultural variables. Dean and others (1985:547) have identified seven potential behavioral responses to environmental risk: mobility, shift of settlement location, subsistence mix, exchange, ceremonialism, agricultural intensification, and defense territory.

It is beyond the scope of the present study to address each of these in equal measure. For the purpose of this study, they will be generally characterized as logistical responses and as behavioral responses. Both will be considered in evaluating the function and role of the Pinenut Site in the context of prehistoric adaptational strategies on Water Canyon Point.

Logistical responses are those concerned with basic survival needs: shelter, food, and tools to acquire and process food for consumption. Logistical responses, then, are manifested in site architecture, subsistence data, and material culture. We need to know whether the inhabitants of the Pinenut Site fulfilled these needs by implementing a seasonal horticultural subsistence strategy whereby agricultural produce was transported elsewhere for redistribution, or if year-round occupation was possible.

Logistical responses will be evaluated through consideration of technology (site architecture and artifact assemblages) and subsistence data (pollen, flotation, and faunal bone). If the inhabitants of the Pinenut Site occupied the locality on a year-round basis, evidence should exist for durable shelter and storage facilities, formalized resource procurement and processing tool kits, and a complex organization of interior task areas within a site. Subsistence data should indicate a relatively restricted range of wild resources, since stored agriculture surplus would have supplied the bulk of the aboriginal diet. Alternatively, if the inhabitants of the Pinenut Site were engaged in more seasonally-restricted (e.g., summer) subsistence activities, then site material culture should exhibit less durable architecture, specialized resource processing tool kits, and a variable range of exterior activity areas within a site. Exterior firehearths should be present if a summer season occupation occurred. Subsistence data should reveal emphases on a wide range of wild plant and animal resources if foraging constituted an important subsistence activity during the crop growing season.

Given these alternative models of differentially-structured strategies, delineation of the logistical organization of on-site activities will be fundamental to the proposed study. Understanding the spatial organization of task groups at the Pinenut Site will be based on analysis of the distribution and correlation of site features with technological and subsistence data. Analyses of the spatial relationships among tool kits and features should reveal the spatial patterning of specific activity areas that delineate the organization of task groups. Correlation of the spatial patterning of activity areas with relevant pollen, macrofloral, and faunal data should reveal whether these groups were engaged in seasonal or long-term subsistence activities in accord with the models explicated above.

Behavioral responses are manifestations of human interaction: exchange systems, the development of decision-making hierarchies (ceremonialism), and territorial defense.

The Pinenut Site is believed to be a Virgin Anasazi site on the basis of the ceramic assemblage, which contains Moapa Ware, Shinarump Ware, and Tusayan Gray Ware and White Ware: Virgin Series. Kayenta Anasazi wares appear rare and limited to redwares. If the different Virgin Anasazi wares in the Pinenut Site assemblage were made by groups in respectively different geographical areas, then the presence of these might indicate inter-group exchange by groups participating in the Virgin Anasazi cultural tradition. The presence of a few Kayenta

Anasazi wares might indicate only limited contact with groups affiliated with the Kayenta Anasazi cultural tradition. This has implications for evaluating the interaction between Virgin and Kayenta groups at certain points in time. Variation in architectural attributes also can potentially inform on exchange, particularly with respect to the function of the pit structure at the Pinenut Site.

Ceremonialism is usually associated with the construction and use of specialized architectural features. It is generally believed that among the Kayenta Anasazi, the semi-subterranean kiva fulfilled both religious and secular functions. Based on ethnographic analogy with modern Pueblo societies, religious activities most often occur during the winter, are concerned with the propagation of crops, and the general well-being of man-land relationships. Secular functions are those which involved redistribution of economic resources (Dean et al. 1985; Lightfoot 1979; Plog 1974). Dean and others (1985:549) state that:

> If economic ceremonialism had such economic functions, the occurrence of Anasazi religious structures might vary in response to environmental perturbations. So-called great kivas are fairly common in the eastern Anasazi area from about A.D. 600 to 1300, and smaller kivas have been integral components of Anasazi settlements since their initial appearance around A.D. 950. The ubiquity of the latter and the failure of both to cluster during intervals of environmental stress suggest that the economic aspects of kiva ceremonialism were subordinate to social and religious functions.

The Virgin Anasazi region is notorious for the apparently rare incidence of kivas. This could be interpreted to mean that ritual ceremonialism was not an important aspect of the Virgin Anasazi cultural tradition or that religious architecture is not recognizable in the archaeological record. Effland et al. (1985:29) have suggested that the shallow bedrock nature of the Kaibab Limestone constrained proper kiva construction and that large structures on Powell Plateau may have had an above-ground kiva function. This suggestion has yet to be verified through excavation and analysis of such large features.

In any case, the presence of a pit structure at the Pinenut Site shows that the construction of semi-subterranean features was possible on Water Canyon Point. The question is whether it functioned as a ceremonial kiva or as a domiciliary pit house. The function of the pit structure will be evaluated through analysis and comparison of the architectural and artifact assemblage attributes to identify ritual or secular activities insofar as they relate to Virgin and Kayenta Anasazi behavioral responses. If a domicilary function is inferred, survey data for Water Canyon Point will be consulted to identify possible ceremonial structures that served to unify the population into a cultural system, whether on a social or economic basis.

Finally, territorial defense has been identified for three periods during the Anasazi occupation of the southern Colorado Plateaus: ca. A.D. 600, ca. A.D. 800, and from about A.D. 1150 to 1300 (Dean et al. 1985: Table 1, p. 549). At the Virgin Anasazi settlement of Lost City on the Muddy River, Shutler (1961:68) noted the situation of defensive sites on ridges above valley floors during the Mesa House phase (ca. A.D. 1100 to 1150, or during the Pueblo III period). Defensive sites are not obvious at Kayenta Anasazi sites on the Grand Canyon North Rim (Effland et al. 1981; Schwartz et al. 1981); it is therefore possible that Kayenta Anasazi groups had abandoned the Grand Canyon North Rim before conditions warranted the need to construct defensive sites.

Based on present survey data, defensive sites do not seem to be obvious on Water Canyon Point; however, access to Water Canyon Point is constrained by three large canyons encircling the north, east, and south. The accessibility of Water Canyon Point will be evaluated through consideration of topographical factors and possible routes of exchange. Disruption of exchange routes, manifested by change in the stylistic attributes of architecture and artifact assemblages, will be explored as possible disruptions of social alliances, thus fostering territorial defense.

These data will be synthesized to produce a general model of Virgin Anasazi adaptational strategies on Water Canyon Point, and evaluated in the context of regional paleoclimate and culture change. Chronological data will be applied to order these synchronic events in time to evaluate diachronic processes in the evolution of prehistoric cultural systems on the Arizona Strip and their relevance to the prehistory of northwestern Arizona.

CHAPTER IV

EXCAVATION METHODOLOGY

Excavation of the Pinenut Site stressed consistent data recovery procedures to ensure comparability of analysis results. A permanent site datum stake was established to serve as a control point for horizontal and vertical proveniences. A Cartesian grid system of 2-m by 2-m squares was then set up across the site. These grids in turn were subdivided into contiguous 1-m by 1-m squares as needed to excavate linear trenches for stratigraphic profiles of the site features. Additional elevational sub-datum points (tied into the primary site datum) were established near the architectural features to monitor vertical proveniences during the excavation of these features.

The investigation of architectural features (Features 1, 2, and 3) commenced by excavating a trench through the fill and exterior areas to obtain stratigraphic profiles of post-abandonment deposition. The profiles were mapped and soil samples collected for pollen and flotation analyses. Samples of carbonized wood, where they occurred, also were collected from respective stratigraphic units for radiocarbon dating purposes.

Excavation commenced by removing cultural/natural fill in 10-cm intervals until clear stratigraphic depositional units were identified in sondage profiles. After mapping and documenting the profiles, the remainder of the fill was removed by stratigraphic unit. All excavated fill was screened through 1/4" mesh screens to ensure systematic recovery of material culture.

In order to obtain reliable information from Feature 1 about prehistoric subsistence and storage emphases, the collection of pollen samples from room interiors was an important aspect of the excavation project. By limiting the initial excavation strategy to interior profile trenches, only a small area of the respective room floors was exposed. After documentation of trench profiles, the remainder of the fill was carefully removed down to a few centimeters above the floor. The floor fill was marked off at 10-cm intervals and removed in 5-cm wide transects across the width of the floor. The newly-exposed floor surface within each transect was scraped and the soil bagged for a composite floor pollen sample.

Because of different preservation factors, not all feature floors could be sampled this way. In Feature 2, the pit structure, only remnants of an originally clay-plastered floor remained; hence, individual patches were scraped for pollen samples. In Feature 1, the floor of Room E was mostly limestone bedrock; hence, pollen samples were collected from floor soil beneath in situ artifacts such as metates.

Feature 4, the trash midden, was investigated by making a complete surface collection of each 2-m by 2-m grid unit on the midden. The midden was then arbitrarily stratified into four quadrants and a single 2-m by 2-m grid unit within each quadrant was chosen by means of a random numbers table. These four respective random grid units were excavated to sterile soil to obtain material culture and pollen/flotation samples from the midden.

Artifacts that occurred on floor surfaces were point-provenienced to allow for reconstruction of activity areas. These were then collected, and each individual feature was mapped, recorded, and photographed.

Extramural areas were investigated by stripping down the ground surface within 2-m by 2-m units around each architectural feature until sterile bedrock was reached. Due to the deflated surface of the site, bedrock most commonly was reached at depths 5 cm to 8 cm below the present ground surface.

Radiocarbon samples were dated by Krueger Enterprises, Inc. Geochron Laboratories Division, Cambridge Massachusetts, and Beta-Analytic, Inc. of Coral Gables, Florida. All artifacts, unprocessed soil and carbon samples, and field records will be curated at the Arizona State Museum, Tucson.

CHAPTER V

ARCHAEOLOGY OF THE PINENUT SITE

Introduction

The Pinenut Site [AZ B:6:44(ASM)] is situated at an elevation of 5440 ft. on a level ridge spur that extends east-northeast from a low wooded ridge out onto a narrow sagebrush-filled trough. The bench is relatively barren, although dense sagebrush grows on the eastern bench slope and several juniper trees grow at the base of the ridge southwest of the bench. The site consists of a linear room block (Feature 1), a slab-outlined pit structure (Feature 2), an isolated slab-lined cist complex (Feature 3), and a deflated sheet trash midden (Feature 4) (Figures 5.1 and 5.2).

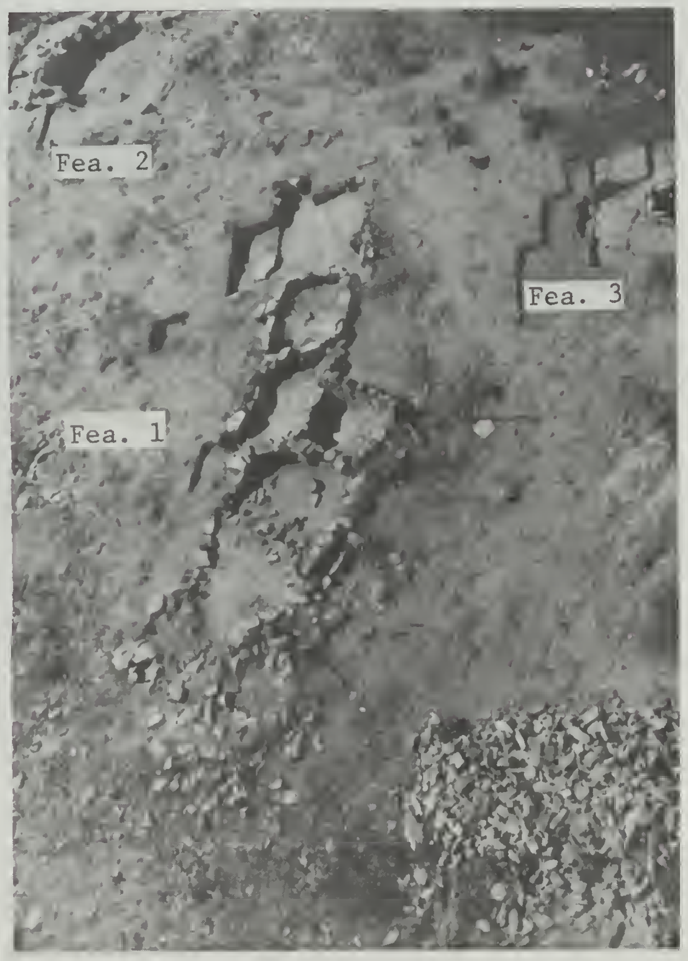


Figure 5.1. Aerial view of the Pinenut Site, facing south. Rubble in right foreground was removed from Feature 1.

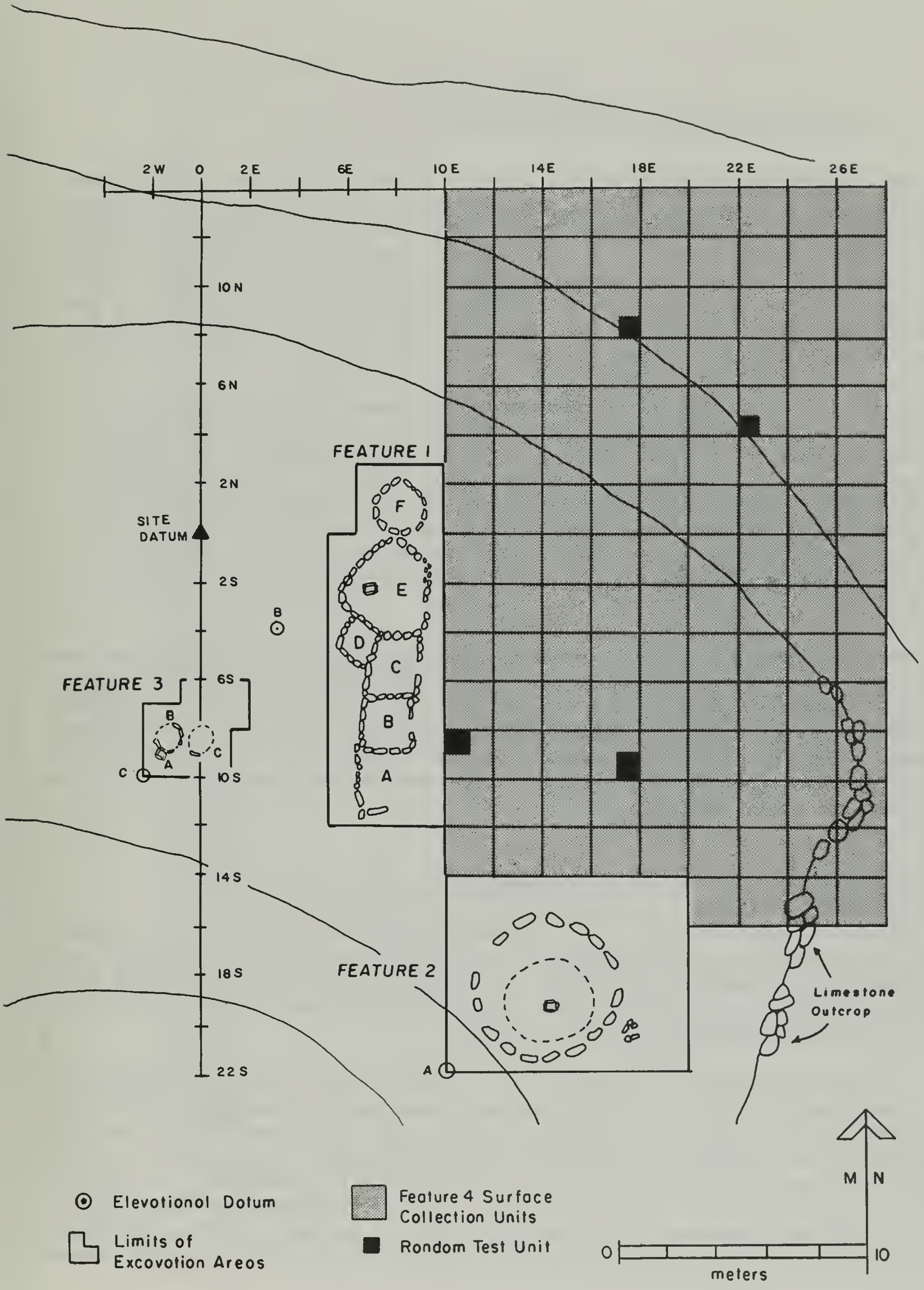


Figure 5.2. Excavation plan map of the Pinenut Site.

Site Stratigraphy

The subsurface stratigraphy of Water Canyon Point has been mapped, in part, by Mr. Thomas L. Rasmussen, geologist for Energy Fuels Nuclear, Inc., Fredonia. Mr. Rasmussen kindly provided a stratigraphic profile of the Harrisburg Member of the Kaibab Limestone, which constitutes the natural stratigraphy of the Pinenut Site setting (Figure 5.3). As shown in the measured section, the architectural features of the Pinenut Site were excavated into "unit 3" of the Harrisburg Formation. Mr. Rasmussen (personal communication 1987) notes that

> [unit 3]...on the measured section shows the stratigraphic location of the excavated site and the site located 1/2 mile east-northeast of the [Pinenut Site]. It appears to me this stratum was chosen for two reasons: first, the three soft layers of gypsiferous, sandy siltstone were easy to dig into, providing the pit for the pit house. Second, the thin 1 to 2-foot thick limestones could easily be removed from the strata and provided excellent, naturally-formed, masonry blocks.

The surface of the bench was overlain by a layer of light tan sandy loam with a high content of chert and limestone gravels. This ranged in thickness from 5 to 8 cm and rested directly on the decomposing limestone bedrock of the upper section of unit 3 of the Harrisburg Member. This topsoil layer was derived from in situ weathering of the bedrock surface and from minor slopewash deposition from the ridge southwest and above the site.

Feature 1

Feature 1 was originally recorded as a low, slightly arc-shaped mound of limestone and sandstone rubble oriented north-to-south and measuring approximately 15 m long, 5 m wide, and averaging 0.75 m high (Westfall 1985b). It is situated on a level surface of the ridge spur and was partially overgrown with sagebrush.

The investigation of Feature 1 commenced by clearing sagebrush from the mound, then staking in grid corners to facilitate mapping and provenience control. The entire rubble mound was mapped in detail, after which the uppermost rocks were removed until room outlines became visible (Figures 5.4, 5.5, and 5.6). A total of six rooms were identified and designated Rooms A, B, C, D, E, and F, respectively (see Figure 5.2). The rooms consist of a probable jacal structure (Room A), four storage rooms (Rooms B, C, D, and F), and a large living room (Room E).

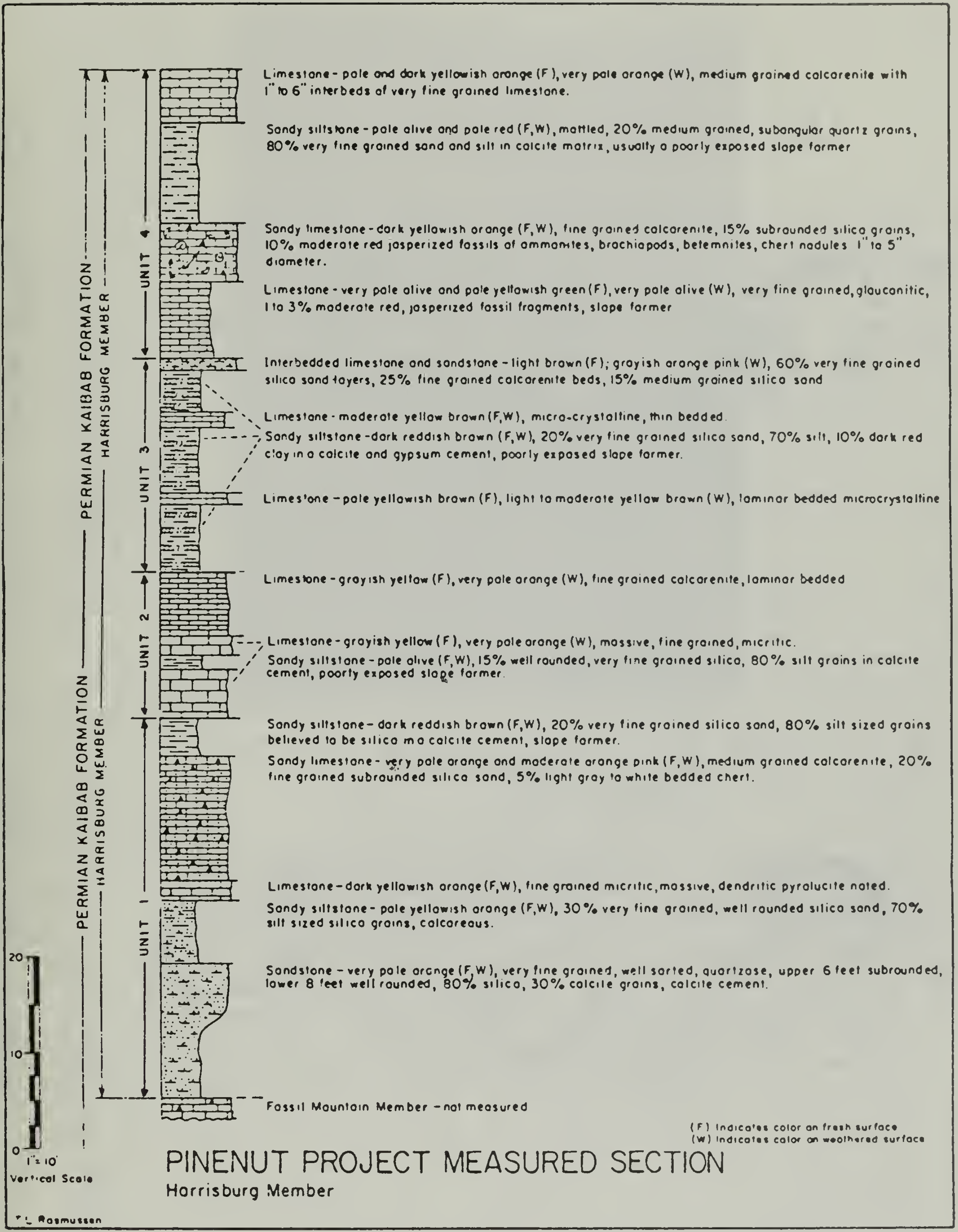

Limestone - pale and dark yellowish orange (F), very pale orange (W), medium grained calcarenite with 1" to 6" interbeds of very fine grained limestone.
Sandy siltstone - pale olive and pale red (F,W), mottled, 20% medium grained, subangular quartz grains, 80% very fine grained sand and silt in calcite matrix, usually a poorly exposed slope former
Sandy limestone - dark yellowish orange (F,W), fine grained calcarenite, 15% subrounded silica grains, 10% moderate red jasperized fossils of ammonites, brachiopods, betemnites, chert nodules 1" to 5" diameter.
Limestone - very pale olive and pale yellowish green (F), very pale olive (W), very fine grained, glauconitic, 1 to 3% moderate red, jasperized fossil fragments, slope former
Interbedded limestone and sandstone - light brown (F); grayish orange pink (W), 60% very fine grained silica sand layers, 25% fine grained calcarenite beds, 15% medium grained silica sand
Limestone - moderate yellow brown (F,W), micro-crystalline, thin bedded.
Sandy siltstone - dark reddish brown (F,W), 20% very fine grained silica sand, 70% silt, 10% dark red clay in a calcite and gypsum cement, poorly exposed slope former.
Limestone - pale yellowish brown (F), light to moderate yellow brown (W), laminar bedded microcrystalline
Limestone - grayish yellow (F), very pale orange (W), fine grained calcarenite, laminar bedded
Limestone - grayish yellow (F), very pale orange (W), massive, fine grained, micritic.
Sandy siltstone - pale olive (F,W), 15% well rounded, very fine grained silica, 80% silt grains in calcite cement, poorly exposed slope former.
Sandy siltstone - dark reddish brown (F,W), 20% very fine grained silica sand, 80% silt sized grains believed to be silica in a calcite cement, slope former.
Sandy limestone - very pale orange and moderate orange pink (F,W), medium grained calcarenite, 20% fine grained subrounded silica sand, 5% light gray to white bedded chert.
Limestone - dark yellowish orange (F,W), fine grained micritic, massive, dendritic pyrolucite noted.
Sandy siltstone - pale yellowish orange (F,W), 30% very fine grained, well rounded silica sand, 70% silt sized silica grains, calcareous.
Sandstone - very pale orange (F,W), very fine grained, well sorted, quartzose, upper 6 feet subrounded, lower 8 feet well rounded, 80% silica, 30% calcite grains, calcite cement.
Fossil Mountain Member - not measured
PERMIAN KAIBAB FORMATION
HARRISBURG MEMBER
UNIT 4
UNIT 3
UNIT 2
UNIT 1
20
10
0
1" = 10'
Vertical Scale
(F) Indicates color on fresh surface
(W) Indicates color on weathered surface
PINENUT PROJECT MEASURED SECTION
Harrisburg Member
T. L. Rasmussen

Figure 5.3. Stratigraphic profile of the Pinenut Site: Harrisburg Member.

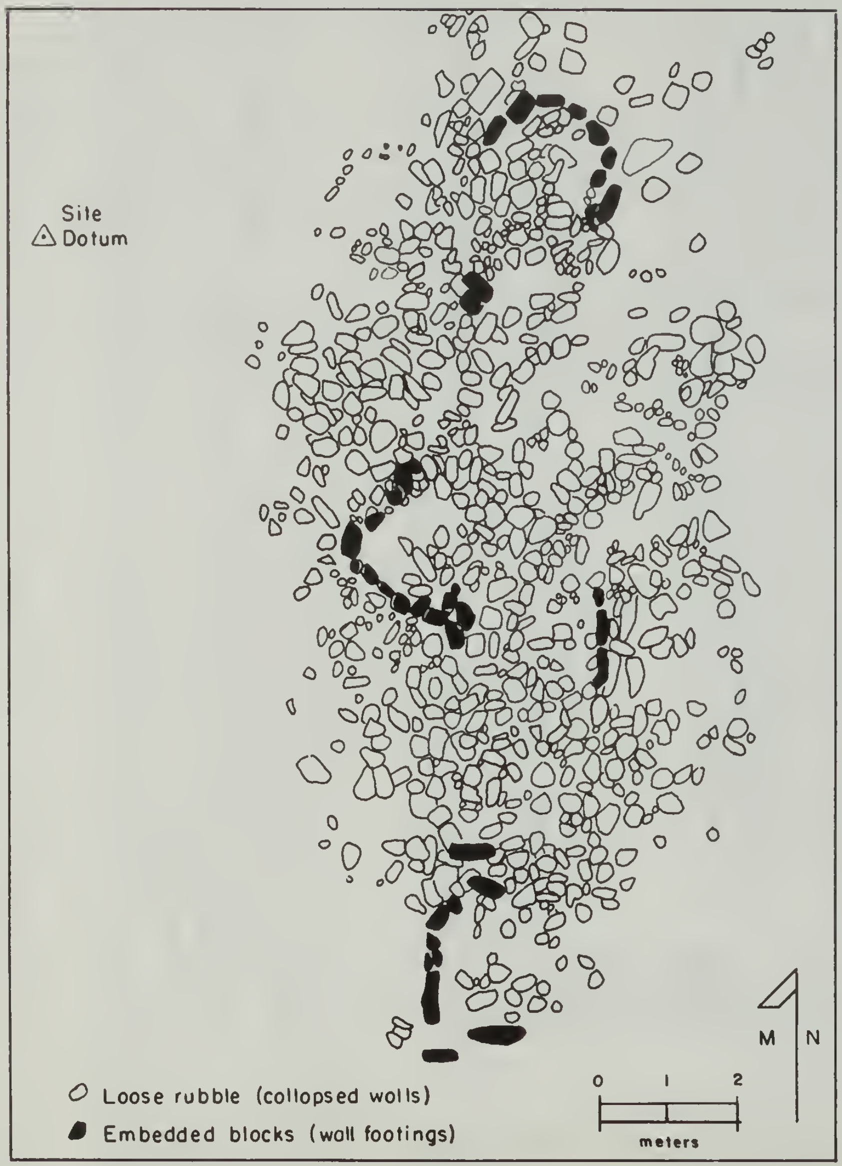

Site
Datum
Loose rubble (collapsed walls)
Embedded blocks (wall footings)
0
1
2
meters
M
N

Figure 5.4. Plan Map of Feature 1 prior to removal of surface rubble.

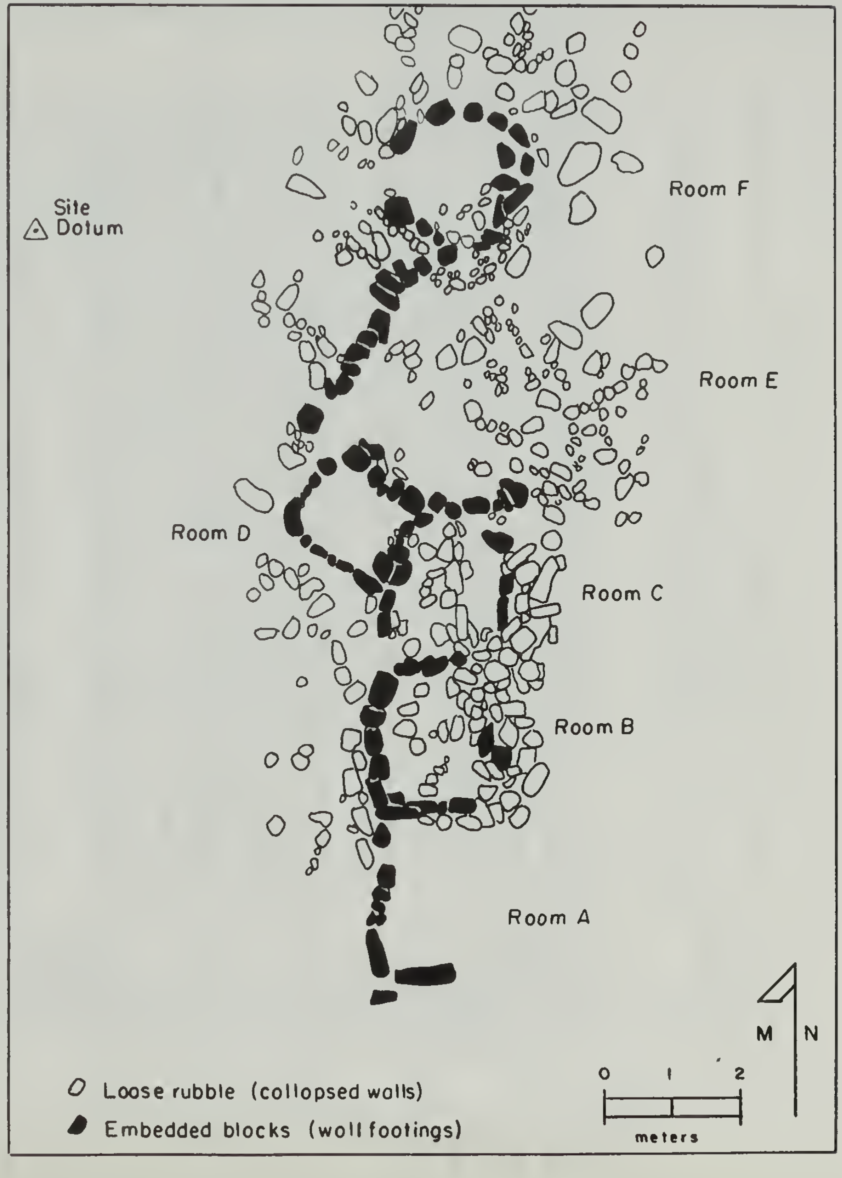

Site
Datum
Room F
Room E
Room D
Room C
Room B
Room A
Loose rubble (collapsed walls)
Embedded blocks (wall footings)
0
1
2
meters
M
N

Figure 5.5. Plan Map of Feature 1 after removal of surface rubble to show room outlines.

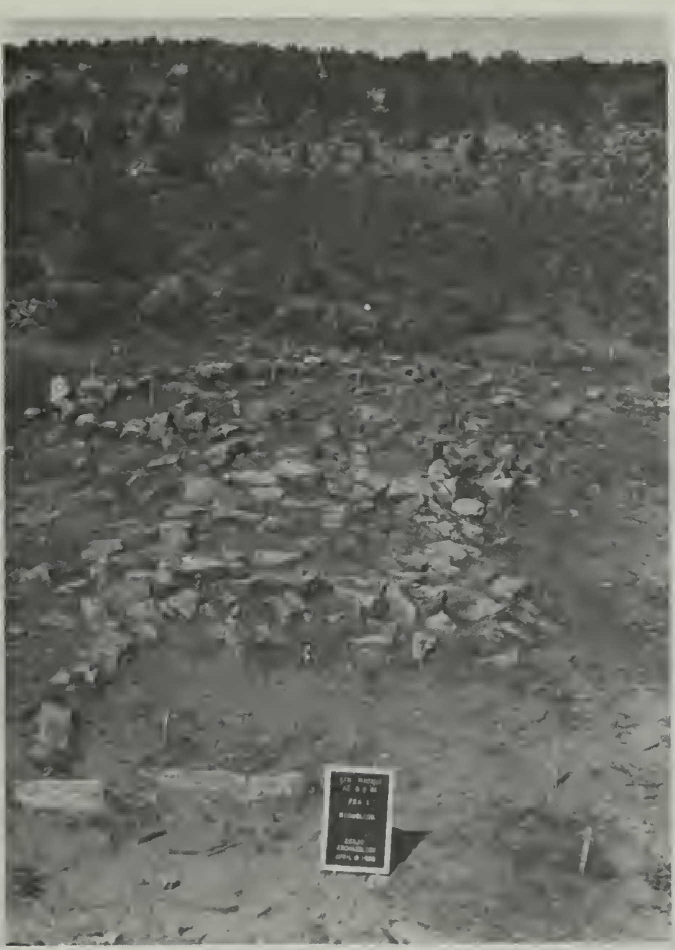


Figure 5.6. Feature 1, viewed to the north to show alignment of rooms.

Room A: Description

Room A is the southernmost component of Feature 1. The room measures 3.00 m north-south by 2.20 m east-west in interior dimensions (Figure 5.7). The virtual absence of rubble and relatively light-duty construction attributes indicate that it may have functioned as a semi-enclosed ramada or jacal-type structure (Figure 5.8).

Room A was prehistorically constructed by excavating a rectangular pit into the decomposing limestone of unit 3 of the Harrisburg Member. Apparently the builders only excavated to the interface of decomposed/hard bedrock, since the hard bedrock floor slopes downward from a depth of 8 cm at the west wall to 22 cm at the east wall. The lower walls encircling the pit consist of the existing south wall of Room B on the north, single courses of limestone rocks on the west and south, and vertical poles on the east, indicated by an arc of three small post sockets. The corners of the room were formed by wall abutments; there was no evidence of masonry bonding. As shown in Figure 5.7, the apparent gap in the southwest corner may indicate an open entryway. The virtual lack of rubble in the vicinity of Room A, with evidence of light-duty pole construction for the east wall, suggest the superstructure might have been a simple framework of poles and brush. The absence of adobe in the fill argues against a wattle-and-daub superstructure.

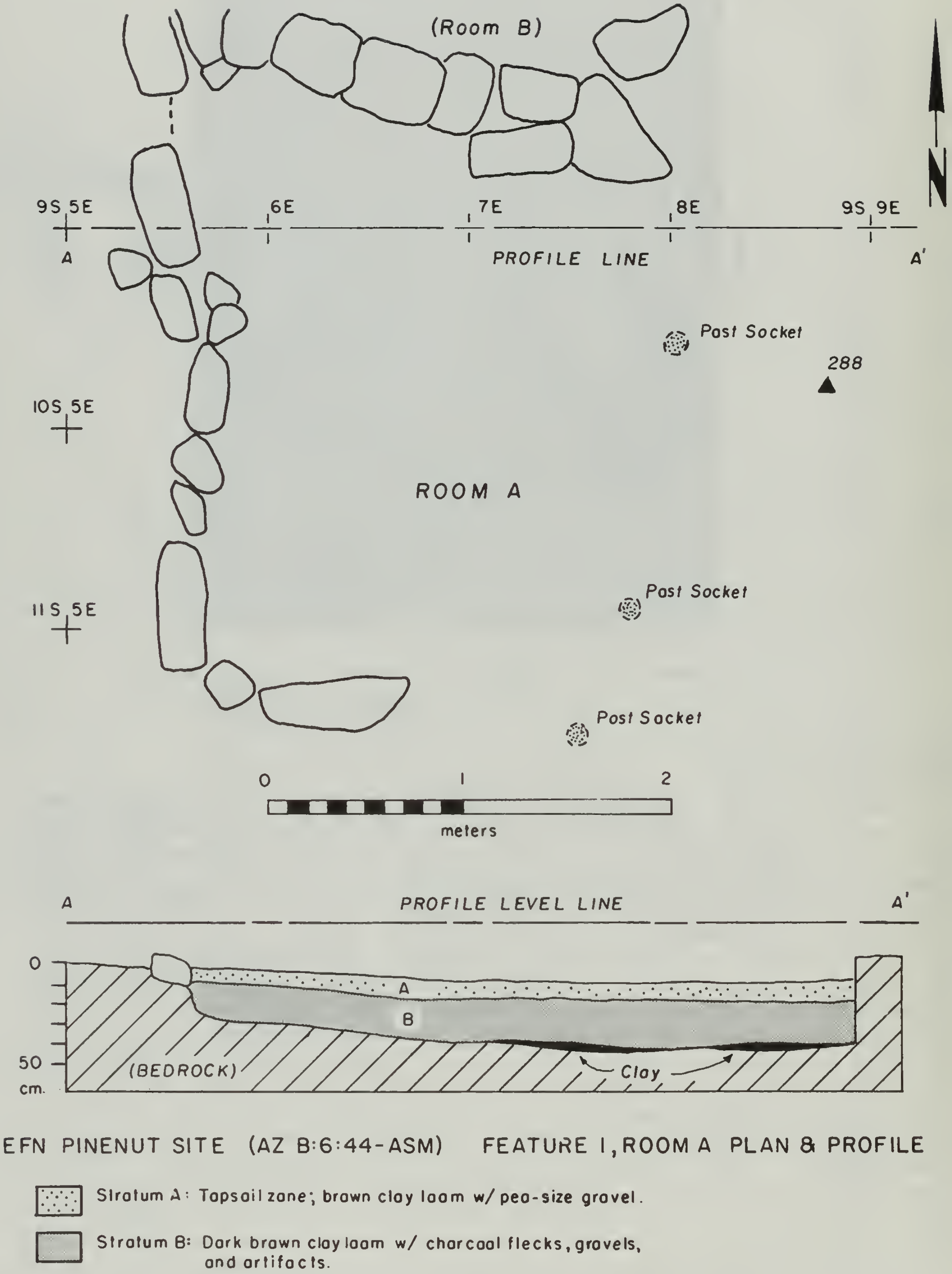

(Room B)
N
9S 5E
6E
7E
8E
9S 9E
A
PROFILE LINE
A'
Post Socket
288
10S 5E
ROOM A
Post Socket
11S 5E
Post Socket
0
1
2
meters
A
PROFILE LEVEL LINE
A'
0
A
B
50
cm.
(BEDROCK)
Clay
EFN PINENUT SITE (AZ B:6:44-ASM) FEATURE 1, ROOM A PLAN & PROFILE
Stratum A: Topsoil zone; brown clay loam w/ pea-size gravel.
Stratum B: Dark brown clay loam w/ charcoal flecks, gravels, and artifacts.

Figure 5.7. Feature 1-Room A: Plan and Profile.

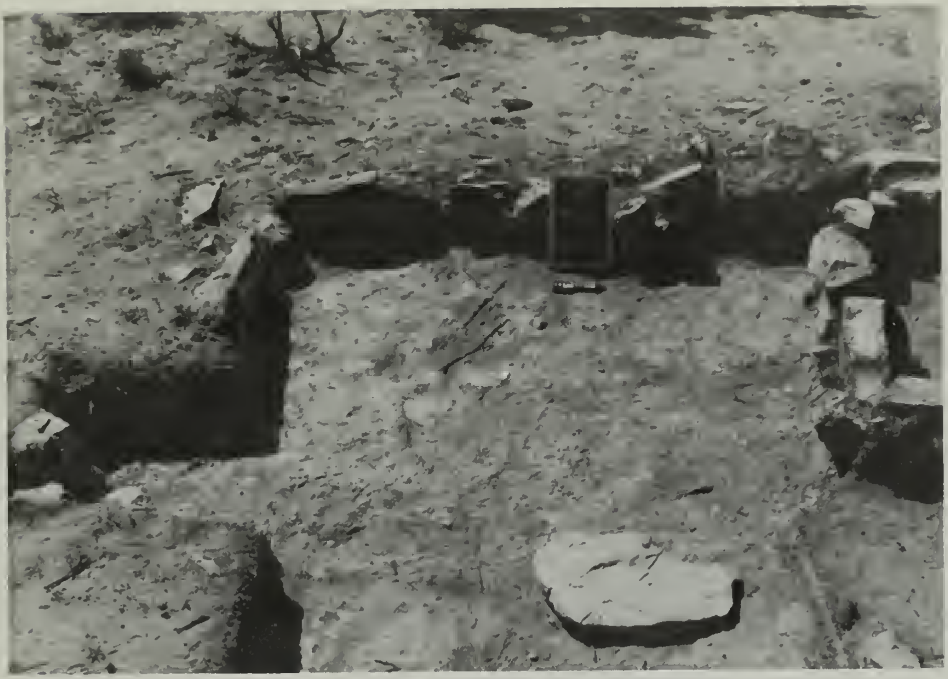


Figure 5.8. Feature 1-Room A, post-excavation photograph, view west.

Two stratigraphic depositional units were identified in the fill of Room A. The upper 10 to 12 cm (Stratum A) consisted of the weathered residual soil of the general site surface. Below this was Stratum B, a 20 to 23-cm thick deposit of dark brown clay loam with charcoal flecks, limestone gravels, and artifacts. Stratum B in turn rested on the decomposing limestone surface of unit 3. In the eastern half of Room A, this surface had been unevenly coated with a 2 to 3-cm thick layer of reddish-to-tan clay. It is suspected that this clay deposit may have functioned both to raise the level of the low eastern floor and to provide a secure footing for the eastern wall posts.

The occurrence and distribution of artifacts within Room A hint at two occupational episodes. The earlier occupation is indicated by a number of lithic tools found on the bedrock surface. The later occupation occurred at the interface of Strata A/B; although a true floor was not discerned, numerous artifacts, including a relatively high frequency of stone tools, were recovered from Stratum A.

Room A: Chronology

Insufficient charcoal was present in Room A to obtain a reliable radiocarbon sample, so the dating of Room A is dependent on relative ceramic cross-dating and stratigraphic context. As shown in Table 5.1, ceramics from the lowermost level of Room A are North Creek Gray and Moapa Gray Ware, both of which are plain graywares implying a pre-A.D. 1050 date. The upper levels are distinguished by the occurrence of corrugated graywares which suggest a post-A.D. 1050 date.

Room A: Artifacts

Artifacts recovered from Room A are summarized in Tables 5.1 and 5.2.

Room A: Subsistence Data

Two pollen samples from Room A were analyzed. Sample 275 is a pollen wash from a mano on the bedrock floor, while Sample 593 is a soil sample collected at the interface of Strata A/B. The mano wash revealed the presence of *Zea* (corn), *Plantago*, *Polygonum* (knotweed), and *Typha* (cattail), indicating these plants may have been processed with the mano during the earlier use of Room A. The only economic species represented in the pollen sample from the Strata A/B interface was *Typha*. In both cases the presence of *Typha* suggests a nearby aquatic habitat and presumably wetter conditions that may have favored the growth of *Zea*. At the very least, these data suggest that Room A was used during the summer season.

Room B: Description

Room B is a small rectangular room with an entryway in the east wall. Room B was prehistorically constructed by excavating a rectangular pit approximately 12 cm deep into the decomposed limestone bedrock of unit 3 of the Harrisburg Member. Large, blocky limestone slabs were then set around the inner perimeter of the pit, leaving a 56-cm wide gap in the center of the east wall for the entryway. The pit was then filled in with a 10 to 18-cm thick deposit of clay. The clay surface was then inlaid with several horizontal limestone slabs; these were concentrated around the inner perimeter of the enclosing walls (Figures 5.9 and 5.10). The southern section of the subfloor of Room B had been disturbed by rodent burrowing.

As can be seen in Figure 5.9, the lower wall footing blocks were overlain by a single course of horizontal limestone slabs. Judging from this and the amount of rubble removed from Room B, it appears that the upper walls were constructed of horizontal masonry. The lower walls form abutted corners; there was no evidence of masonry bonding. The interior dimensions of Room B are 1.82 m north-south, 1.58 m east-west, and 0.52 m deep from the top of the remaining lower wall. It is estimated that the room walls originally extended one story high.

The interior fill of Room B consisted of two depositional units. Stratum A was a thick deposit of collapsed wall rubble in a matrix of reddish-brown, gravelly clay loam, ranging in thickness from 30 to 34 cm. This overlaid Stratum B, a deposit of orangish-brown clay loam with charcoal flecks, charcoal pieces, and artifacts. Stratum B ranged from 10 to 12 cm thick and rested directly on the floor. Stratum B is believed to represent the burned collapsed roof of Room B.

No interior floor features occurred in Room B.

TABLE 5.1 . Feature 1 - Room A: Ceramic Type Frequencies.

PROVENIENCE \ WARE / Type	TUSAYAN GRAY WARE & WHITE WARE: VIRGIN SERIES	North Creek Gray	North Creek Corrugated	St. George B/G	Unidentified B/W	B/W Corrugated	SHINARUMP GRAY WARE & WHITE WARE	Shinarump Brown	Shinarump Corrugated	Unidentified B/G	Virgin B/W	Toquerville B/W	MOAPA GRAY WARE & WHITE WARE	Boulder Gray	Moapa Corrugated	Moapa B/G	B/W Corrugated	SAN JUAN RED WARE: LITTLE COLORADO SERIES	Tusayan B/R	TSEGI ORANGE WARE	TOTAL
Level 1 (Strat.A)																					0
Level 2 (Strat.B)		10	9		4	2		7	25		2	1		25	13	1	2	1			102
Level 3 (Strat.B)		1			1	1		2	2					2	1						10
Level 4 (Strat.B)		1											1								2
TOTALS:		12	9		5	3		9	27		2	1	1	27	14	1	2	1			114

TABLE 5.2 . Feature 1 - Room A: Lithic Artifact Frequencies.

PROVENIENCE \ ARTIFACT TYPE	Projectile Point	Biface	Drill	Notched Tool	Graver	Edge-Abraded Flake Tool	Scraper	Denticulate Tool	Miscellaneous Retouched Flake	Utilized Flake	Core	Hammerstone	Hammerstone Resharpening Flake	Pecking Stone	Hoe/ Digging Implement	Debitage	Mano: 1-hand	Mano: 2-hand	Trough Metate	Grinding Slab	Abrading Stone	Shaftsmoother	Miscellaneous Ground Piece	TOTAL
Level 1 (Str.A)	1	2					1		1	3			5		1			1						15
Level 2 (Str.A/B	2		2			1			1	2		1	1		1									11
Level 3 (Str.B)	3	3								7	1									1				15
Floor			1							1		1						1						4
Sub-floor		1																						1
All Levels																94								94
TOTAL	6	6	3			1	1		2	13	1	2	6		2	94		2		1				140

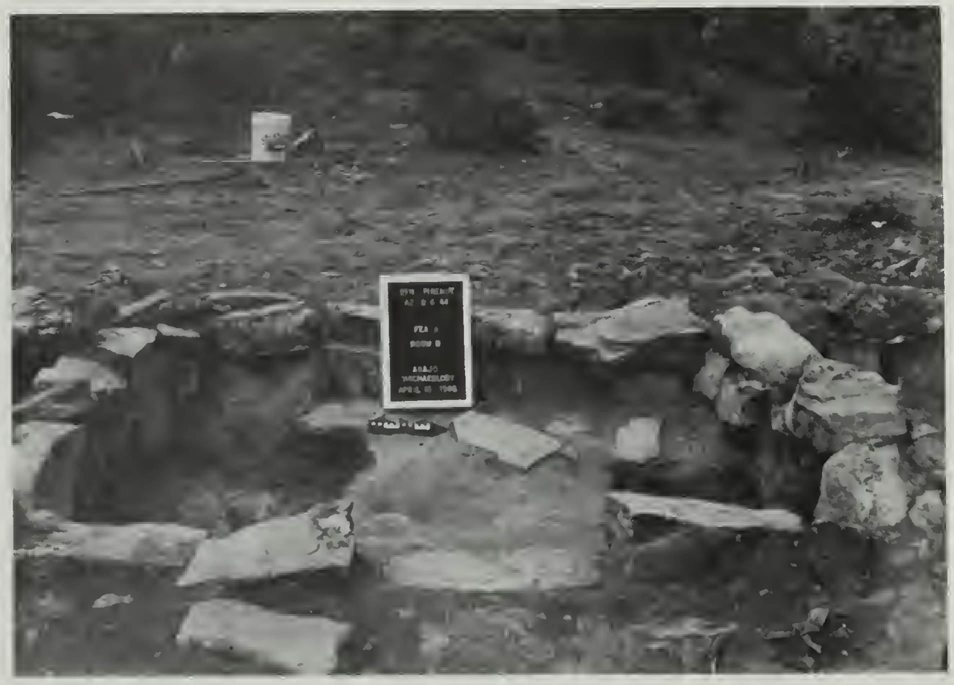


Figure 5.9. Feature 1-Room B, post-excavation photograph, view west.

Room B: Chronology

A sample of burned wood from Stratum C yielded a radiocarbon date of A.D. 1080±60 (Beta 633:870±60 B.P.). A single sherd of St. George Black-on-gray was recovered from the floor; this ceramic type is believed to have a temporal range from A.D. 900 to 1100 (Pueblo I-Pueblo II) (Thompson 1986:355). The overlap of the radiocarbon date and ceramic date would indicate that Room B was constructed and used some time between A.D. 900 and 1100.

Room B: Artifacts

Artifacts recovered from Room B are summarized in Tables 5.3 and 5.4.

Room B: Subsistence Date

Sample 595, collected from the floor surface of Room B, exhibited small quantities of Zea (corn) and small aggregates of High-spine Compositae (cf. sunflower), which may indicate the storage of these species in this room.

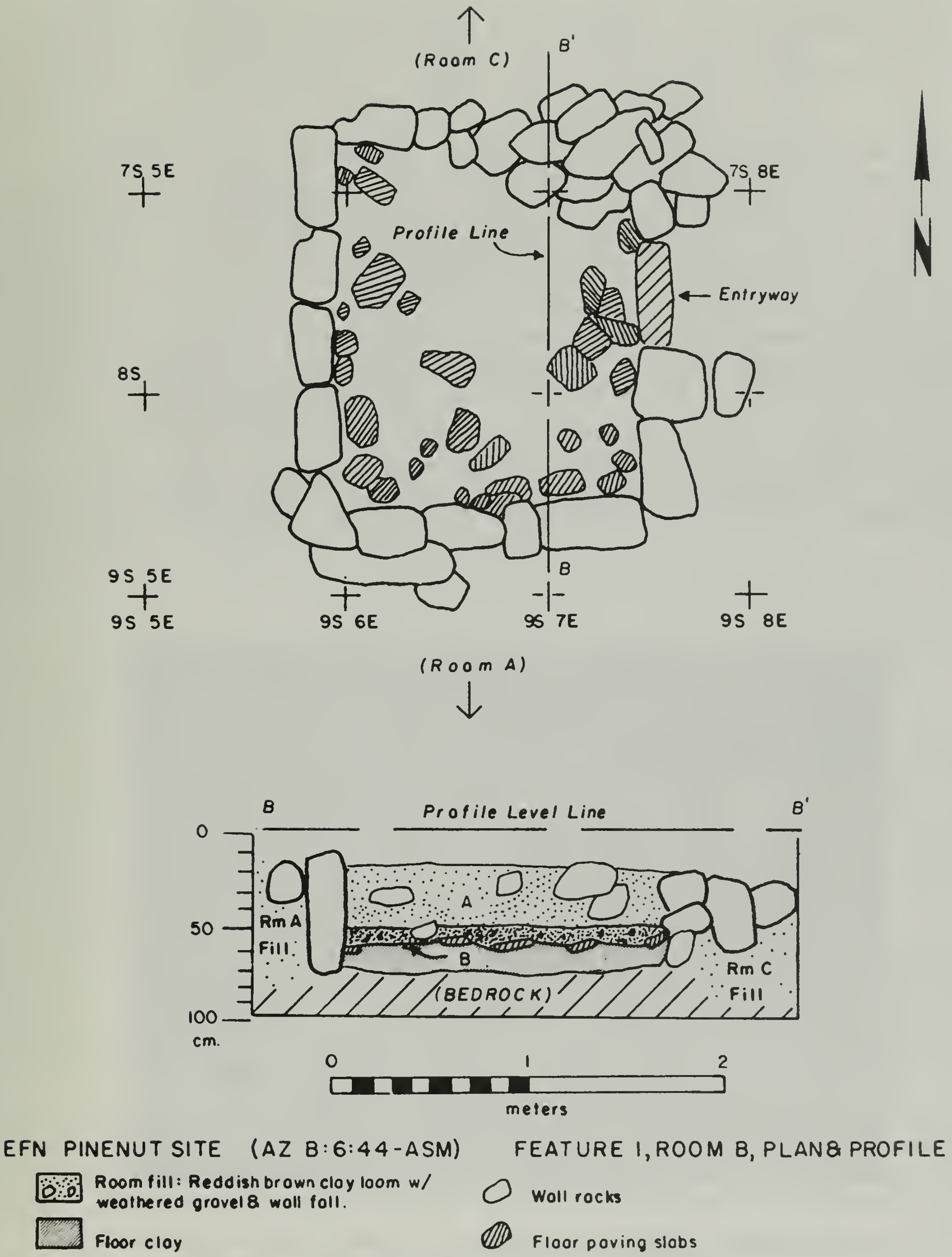


Figure 5.10. Feature 1-Room B: Plan and Profile.

TABLE 5.3 . Feature 1 - Room B: Ceramic Type Frequencies.

PROVENIENCE / WARE / Type	TUSAYAN GRAY WARE & WHITE WARE: VIRGIN SERIES	North Creek Gray	North Creek Corrugated	St. George B/G	Unidentified B/W	B/W Corrugated	SHINARUMP GRAY WARE & WHITE WARE	Shinarump Brown	Shinarump Corrugated	Unidentified B/G	Virgin B/W	Toquerville B/W	MOAPA GRAY WARE & WHITE WARE	Boulder Gray	Moapa Corrugated	Moapa B/G	B/W Corrugated	SAN JUAN RED WARE: LITTLE COLORADO SERIES	Tusayan B/R	TSEGI ORANGE WARE	TOTAL
Level 1 (Strat.A)			5					2	1					1	2						11
Level 2 (Strat.A)		1	3											1							5
Level 3 (Strat.A)																					0
Level 4 (Strat.B)		5	22	1				4	1					5				1			39
TOTALS:		6	30	1				6	2					7	2			1			55

TABLE 5.4 . Feature 1 - Room B: Lithic Artifact Frequencies.

PROVENIENCE / ARTIFACT TYPE	Projectile Point	Biface	Drill	Notched Tool	Graver	Edge-Abraded Flake Tool	Scraper	Denticulate Tool	Miscellaneous Retouched Flake	Utilized Flake	Core	Hammerstone	Hammerstone Resharpening Flake	Pecking Stone	Hoe/ Digging Implement	Debitage	Mano: 1-hand	Mano: 2-hand	Trough Metate	Grinding Slab	Abrading Stone	Shaftsmoother	Miscellaneous Ground Piece	TOTAL
Level 1 (Str.A)	1	1								1			3											6
Level 2 (Str.A)												1							1*		1		1	4
Level 3 (Str.A)																								0
Level 4 (Str.B)										1								2	1*					4
Floor		1																						1
Sub-floor																							1*	1
All Levels																41								41
TOTAL	1	2								2		1	3			41		2	2*		1		2	57

* Indicates recovery from wall of Room B. Ground stone fragments were used for wall construction, not as grinding implements in Room B.

Room C: Description

Room C abuts Room B on the north (Figure 5.11). Unlike Room B which is rectangular in form, Room C is slightly ovoid and has a pronounced tilt to the northeast (Figure 5.12). In this respect, Room C is typical of the tendency of Virgin Anasazi room blocks to form a gentle arc shape (cf. Dalley and McFadden 1986; Walling et al. 1986).

Room C was constructed prehistorically in a manner similar to Room B. A rectangular pit was excavated approximately 15 cm deep into the decomposed limestone of unit 3 of the Harrisburg Member. The interior perimeter of the pit was then lined with irregular limestone blocks, leaving a gap in the northeast corner for an entryway. The pit was then filled in with a 10-cm thick deposit of reddish-brown clay, into which flat limestone slabs were laid to form the floor. These slabs did not span the entire floor but were concentrated mainly along the inner perimeter of the lower walls. The interior dimensions of Room E are 2.10 m north-south, 1.90 m east-west, and 0.50 m deep from the top of the remaining lower wall.

The upper walls most likely were similar to those of Room B, that is, horizontal masonry extending perhaps one story high. No evidence of corner bonding was present; rather blocks appear to have been lapped at irregular intervals to form the corners.

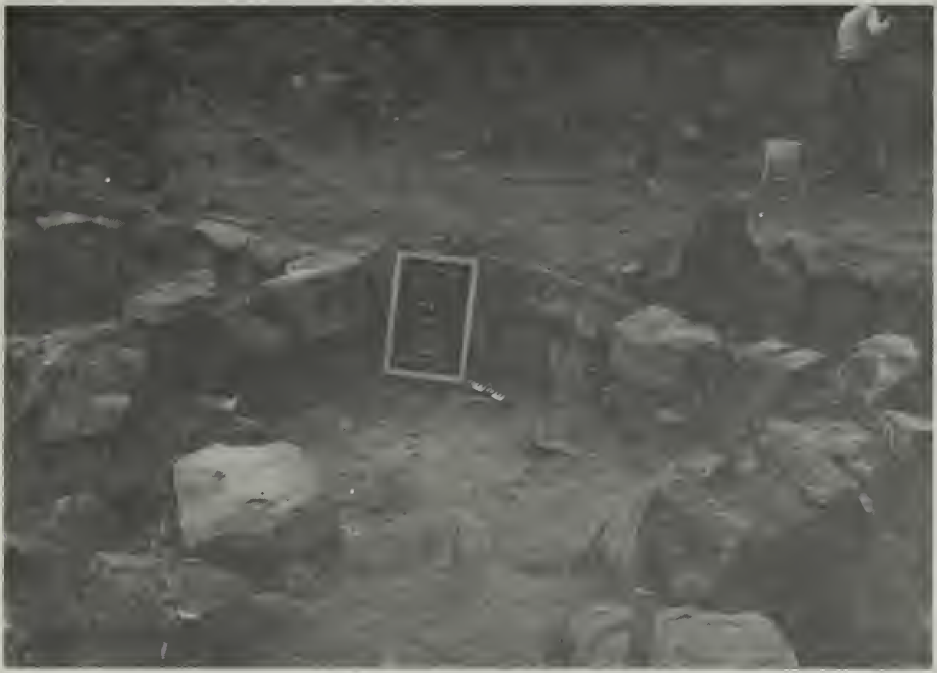


Figure 5.11. Feature 1-Room C, post-excavation photograph, view southwest.

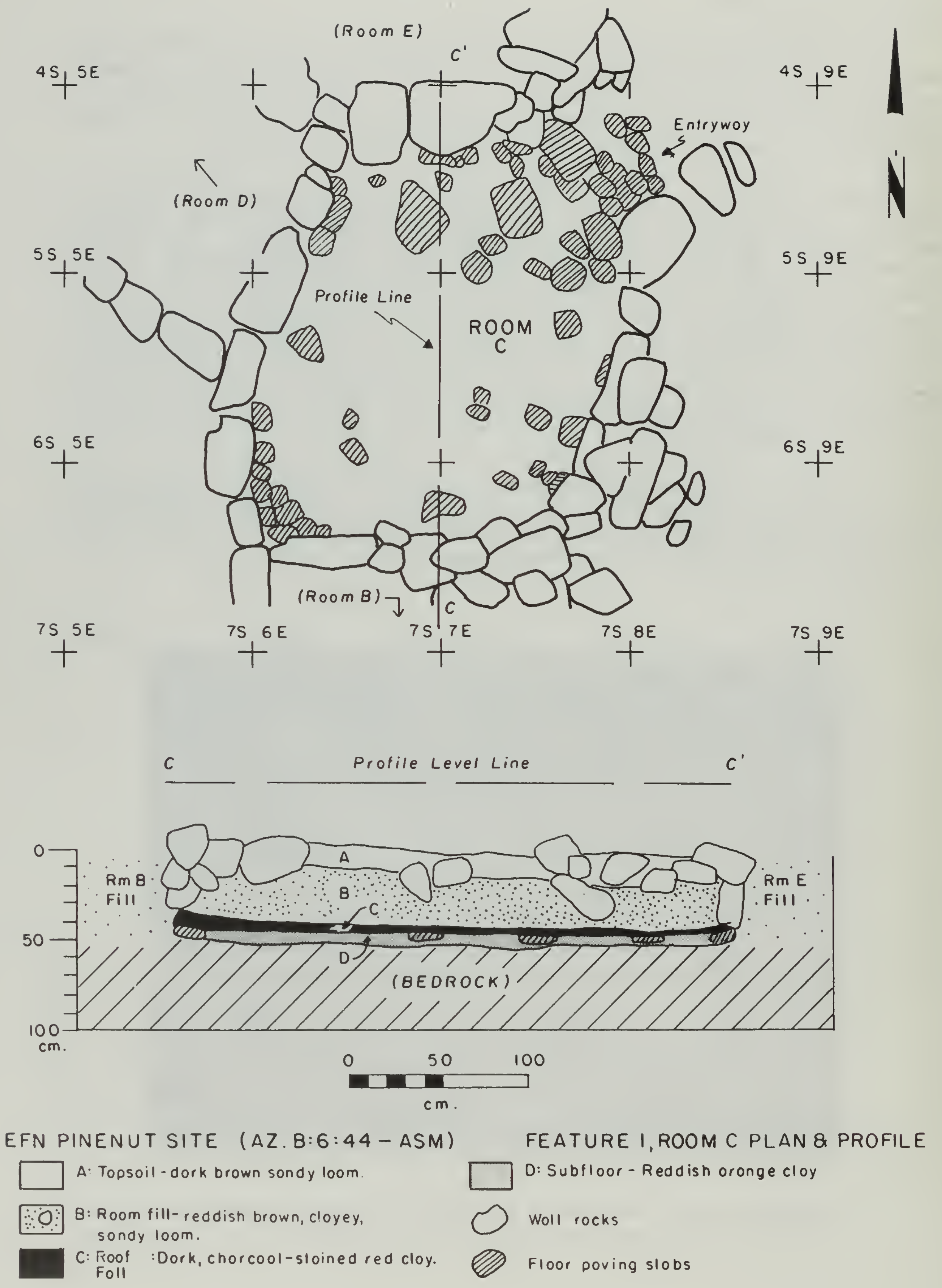

(Room E)
C'
4S 5E
4S 9E
Entryway
(Room D)
5S 5E
5S 9E
Profile Line
ROOM C
6S 5E
6S 9E
(Room B)
C
7S 5E
7S 6E
7S 7E
7S 8E
7S 9E
N
C
Profile Level Line
C'
0
50
100
cm.
Rm B Fill
A
B
C
D
(BEDROCK)
Rm E Fill
0
50
100
cm.
EFN PINENUT SITE (AZ. B:6:44 – ASM)
FEATURE 1, ROOM C PLAN & PROFILE
A: Topsoil - dark brown sandy loam.
B: Room fill - reddish brown, clayey, sandy loam.
C: Roof Fall :Dark, charcoal-stained red clay.
D: Subfloor - Reddish orange clay
Wall rocks
Floor paving slabs

Figure 5.12. Feature 1-Room C: Plan and Profile.

The interior fill of Room C consisted of three depositional units. Stratum A was a dark brown sandy loam averaging 11 cm thick and containing limestone rubble. Stratum B consisted of reddish-brown sandy clay loam and limestone rubble, indicating fallen upper wall debris, and ranging from 18 to 22 cm in thickness. Stratum C was a 5 to 12-cm thick layer of dark-stained red clay with abundant charcoal flecks and several large pieces of burned wood. Most likely, Stratum C represents the burned collapsed roof of Room C, resting directly on the floor.

No interior floor features occurred within Room C.

Room C: Chronology

A burned wood sample from the base of Stratum C near the floor of Room C yielded a radiocarbon date of A.D. 1290±60 (Krueger 635:660±60 B.P.). Additional support for this late date comes from a sherd of Moapa Black-on-gray recovered from the same stratigraphic unit; the temporal span of Moapa Black-on-gray is A.D. 1100 to 1225/1250 (Thompson 1986:355). Based on these dates the construction and use of Room C probably occurred between A.D. 1100 and A.D. 1290.

Room C: Artifacts

Artifacts recovered from Room C are summarized in Tables 5.5 and 5.6.

Room C: Subsistence Data

Sample 597 collected from the floor of Room C exhibited small quantities of *Zea* (corn) pollen, indicating this species may have been stored in this room, as in Room B. Moreover, the sample showed a high quantity of Cheno-am pollen (*Chenopodium*, goosefoot, and *Amaranthus*, pigweed), accompanied by large aggregates of these pollen types. The presence of aggregates is a good indication that *Chenopodium* and *Amaranthus* species were stored in bulk in this room. In addition, these weedy species might be considered cultivars which were encouraged in agricultural fields (Scott, Chapter 9, this volume).

Room D: Description

Nestled between Room C and Room E, Room D is a small rectangular room measuring 1.21 m northeast-southwest, 1.25 m northwest-southeast, and is 0.44 m deep from the top of the lower walls (Figures 5.13 and 5.14). Room D was constructed after the burning, collapse, and abandonment of Rooms B and C. Room D is the best-preserved of all the rooms in Feature 1, exhibiting less deterioration than that observed in the other rooms. This is undoubtedly a function of its later construction date.

TABLE 5.5 . Feature 1 - Room C: Ceramic Type Frequencies.

PROVENIENCE / WARE / Type	TUSAYAN GRAY WARE & WHITE WARE: VIRGIN SERIES	North Creek Gray	North Creek Corrugated	St. George B/G	Unidentified B/W	B/W Corrugated	SHINARUMP GRAY WARE & WHITE WARE	Shinarump Brown	Shinarump Corrugated	Unidentified B/G	Virgin B/W	Toquerville B/W	MOAPA GRAY WARE & WHITE WARE	Boulder Gray	Moapa Corrugated	Moapa B/G	B/W Corrugated	SAN JUAN RED WARE: LITTLE COLORADO SERIES	Tusayan B/R	TSEGI ORANGE WARE	TOTAL
Levels 2-2 (Strat. B)		2	2		1				1		1			3	2			1			13
Levels 4-5 (Strat. C)		1	1											2	1	1					6
TOTALS:		3	3		1					1		1		5	3	1		1			19

TABLE 5.6 . Feature 1 - Room C: Lithic Artifact Frequencies.

PROVENIENCE / ARTIFACT TYPE	Projectile Point	Biface	Drill	Notched Tool	Graver	Edge-Abraded Flake Tool	Scraper	Denticulate Tool	Miscellaneous Retouched Flake	Utilized Flake	Core	Hammerstone	Hammerstone Resharpening Flake	Pecking Stone	Hoe/ Digging Implement	Debitage	Mano: 1-hand	Mano: 2-hand	Trough Metate	Grinding Slab	Abrading Stone	Shaftsmoother	Miscellaneous Ground Piece	TOTAL
Level 1 (Str.A)		1											3											4
Level 2 (Str.A)												1												1
Level 3 (Str.B)	1																							1
Level 4 (Str.C)										1														1
Floor		1								1							1							3
All Levels																6								6
TOTAL	1	2								2		1	3			6	1							16

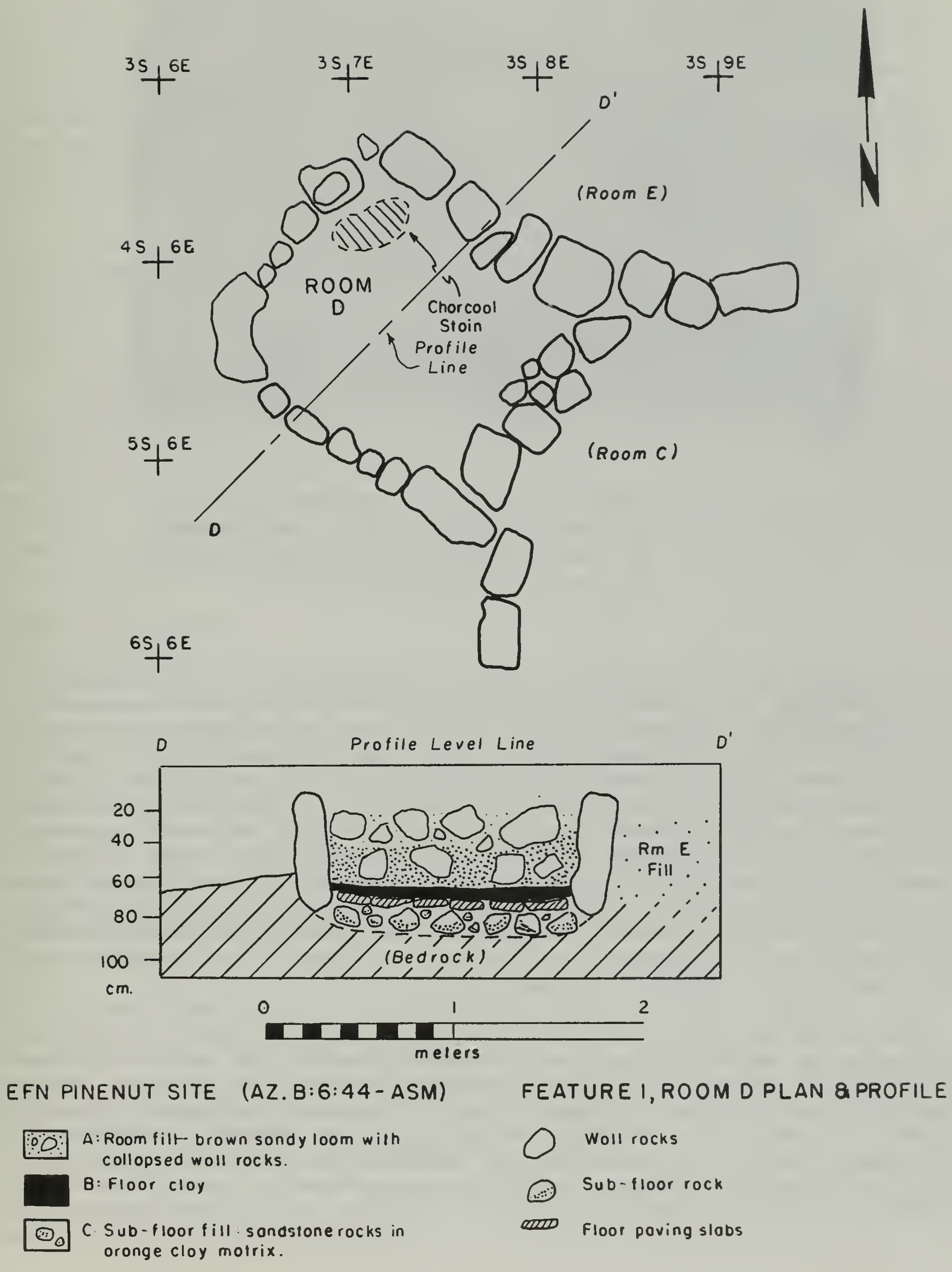


Figure 5.13. Feature 1-Room D: Plan and Profile.

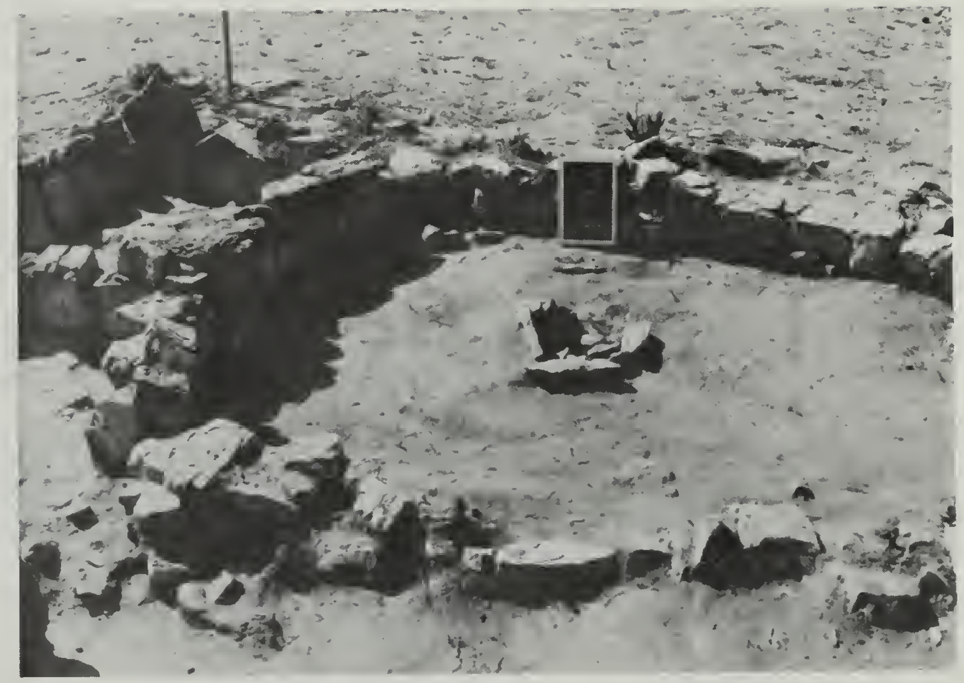


Figure 5.14. Feature 1-Room D, post-excavation photo. Room E is in the center, and Room D is to the left of Room E; view to the west.

Overall, Room D exhibits greater sophistication in construction than is evident in Rooms B and C. It was constructed by first excavating a rectangular pit approximately 0.25 m down into the decomposed limestone of unit 3 of the Harrisburg Member. Then, unlike Rooms B and C which utilized clay for the sub-floor matrix, the pit for Room D was inlaid with numerous well-placed stones and clay. This sub-floor fill was then overlain with closely-fitted flat slabs and the whole covered over with a 3 to 5-cm thick coat of clean reddish-brown clay. A large charcoal stain occurred on the northwest quadrant of the floor, from which a sample of burned wood was collected for radiocarbon dating. Since there was no evidence that Room D had burned, and no firehearth was identified, the deposition of the charcoal is problematic. No floor features were present in Room D.

It is worth noting the marked difference in the floor construction technology of Room D in contrast to that in Rooms A, B, and C. Floors such as the one in Room D seem to be characteristic of middle to late Pueblo II structures reported in the Virgin River drainage, whereas Pueblo I structures, on the average appear to exhibit less of this technology (Dalley and McFadden 1986; Walling et al. 1986). Moreover, these authors also suggest that the preparation of rock-filled and slab-lined floors may have functioned to prevent rodents from burrowing up through storage room floors. Hence, this construction technology has implications for evaluating the temporal significance of architectural attributes as it relates to subsistence activity.

Only the lower walls of Room D remained in situ. These were constructed of large, semi-dressed, vertical limestone slabs fitted closely together to form a continuous wall on the southwest and northwest. The northeast wall is a common wall with Room E, while the southeast wall is a common wall with Room C. The northeast and southeast corners abut Rooms E and C, respectively. The upper walls and roof had collapsed inwards; it is probable that the upper walls were horizontal masonry walls cemented with mud mortar. As will be discussed shortly, the roof was most likely made of poles and clay plastered over with mud.

No indication of an entryway was found. Since Room D was appended to the exteriors of Rooms C and E after the inward collapse of Rooms B and C, it is likely that entry was gained from Room E by means of a small opening in the now-absent upper wall, or possibly through the roof.

Three depositional units were identified in the interior fill of Room D. Stratum A consisted of collapsed upper wall rubble and light brown, gravelly sandy loam averaging 11 cm thick. Stratum B was a 17-cm thick deposit of dark brown loamy fill laden with pebbles, cobbles, fractured limestone spalls, and numerous artifacts. Stratum C was a reddish-brown clayey loam resting directly on the floor of Room D; this is believed to represent the collapsed roof of the room. There is no evidence that Room D had burned.

Room D: Chronology

Dating Room D is somewhat problematic. A sample collected from the charcoal deposit on the floor in the northwest corner of Room D yielded a radiocarbon date of A.D. 1360 (Krueger 636: 590±85 B.P.). This is a significantly later date than those provided for Rooms B, C, and E, which span the A.D. 1245 to 1290 time range. Moreover, we are unable to explain how the charcoal came to be deposited in Room D since this room did not burn. Possibly, charcoal from the hearth in adjacent Room E was redeposited into Room D. In any case, the standard deviation would extend this date back in time to A.D. 1275 as the earliest possible date the charcoal was deposited in the room, thus placing the use and abandonment of Room D within the span of the terminal occupation of Feature 1.

In addition to the architectural evidence which clearly shows Room D was constructed after Rooms B, C, and E, it is noteworthy that Room D also had the highest frequency of Shinarump Wares. While the precise temporal range of the Shinarump Wares is debatable, it is worth noting that Shinarump Corrugated has been reported elsewhere in relatively late contexts (Moffit et al. 1978; Westfall et al. in press; Wilson 1985) and that Colton (1952) originally considered Shinarump Corrugated a Pueblo III type. Moreover, the presence of Moapa Black-on-gray and Virgin Black-on-white in Stratum C, also argues for a relatively late date of construction for Room D.

Room D: Artifacts

Artifacts recovered from Room D are summarized in Tables 5.7 and 5.8.

Room D: Subsistence Data

Sample 598 from the floor of Room D revealed the pollen of *Zea* (corn), large aggregates of Cheno-am pollen (*Chenopodium*, goosefoot and *Amaranthus*, pigweed), and High-spine Compositae (cf. sunflower), indicating that these species were probably stored in Room D. Notable is the presence of Cheno-am aggregates in association with *Zea* which suggests that Cheno-ams may have been encouraged as agricultural cultivars (Scott, Chapter IX, this volume).

Room E: Description

Room E is distinguished from all the other rooms in Feature 1 by architectural attributes, interior stratigraphy, and the presence of floor features. Room E also evidenced heavy burning, and the recovery of numerous in situ floor artifacts suggests that it burned during the prehistoric occupation.

Room E is a generally ovoid-shaped room with the long axis oriented slightly northeast-southwest. The maximum interior dimensions of Room E are 4.00 m north-south by 3.25 m east-west; from the top of the remaining wall slabs the floor ranges from 0.30 m deep at the north end to 0.50 m at the south end (Figures 5.14, 5.15, and 5.16).

Room E was built over an exposed section of the unit 3 bedrock. This was obvious in the north end of the room where bedrock limited the depth of the floor. The bedrock slopes gently downwards to the south. Here, the prehistoric builders attempted to level the floor by laying down a 20-cm to 5-cm thick deposit of clayey soil. A light tan-colored clay was then spread over this fill to form a floor surface, although it appears that the bedrock in the north end was left exposed.

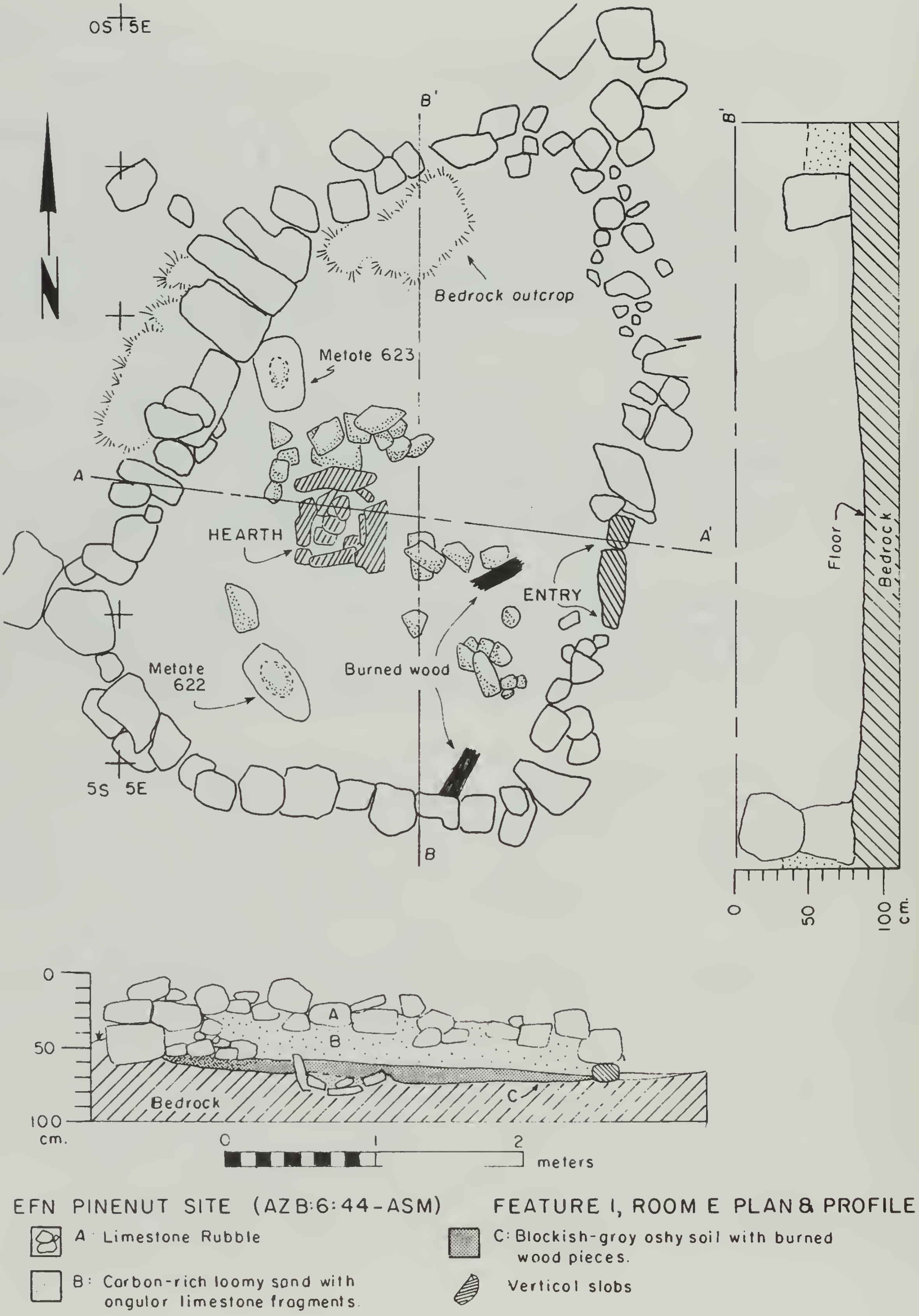
The lower walls encircling Room E were constructed of large limestone blocks and angular boulders set vertically on the floor fill along the south, west, and north; however, only a single course of angular boulders remained along the east wall. It appears that the east wall was not as well-constructed as the other walls of Room E. The south wall of Room E is a common wall with Room C and the north wall is a common wall with Room F. An entryway is indicated by a 0.60-m wide gap in the east wall, oriented 110° east, where it would receive direct winter morning sunshine. During the clearing of the exterior of Feature 1, a deposit of trashy soil was encountered immediately outside the entryway. Subsequent excavation of Grid Unit 3S/8E yielded a high frequency of broken tools and numerous sherds. It is thought that this accumulated debris reflects expedient disposal of trash immediately outside the entryway, or a possible exterior activity area.

TABLE 5.7 . Feature 1 - Room D: Ceramic Type Frequencies.

PROVENIENCE \ WARE / Type	TUSAYAN GRAY WARE & WHITE WARE: VIRGIN SERIES	North Creek Gray	North Creek Corrugated	St. George B/G	Unidentified B/W	B/W Corrugated	SHINARUMP GRAY WARE & WHITE WARE	Shinarump Brown	Shinarump Corrugated	Unidentified B/G	Virgin B/W	Toquerville B/W	MOAPA GRAY WARE & WHITE WARE	Boulder Gray	Moapa Corrugated	Moapa B/G	B/W Corrugated	SAN JUAN RED WARE: LITTLE COLORADO SERIES	Tusayan B/R	TSEGI ORANGE WARE	TOTAL
Level 1 (Strat.A)		2	12					2	8		1			10	1			3			39
Level 2 (Strat.B)		4	3		1	1		9	22					11	3			1			55
Level 3 (Strat.C)		2	1		2				4		1			5		1	1	2			19
Floor								2	10												12
TOTALS:		8	16		3	1		13	44		2			26	4	1	1	6			125

TABLE 5.8 . Feature 1 - Room D: Lithic Artifact Frequencies.

PROVENIENCE \ ARTIFACT TYPE	Projectile Point	Biface	Drill	Notched Tool	Graver	Edge-Abraded Flake Tool	Scraper	Denticulate Tool	Miscellaneous Retouched Flake	Utilized Flake	Core	Hammerstone	Hammerstone Resharpening Flake	Pecking Stone	Hoe/ Digging Implement	Debitage	Mano: 1-hand	Mano: 2-hand	Trough Metate	Grinding Slab	Abrading Stone	Shaftsmoother	Miscellaneous Ground Piece	TOTAL
Level 1 (Str.A)	1											1	1											3
Level 2 (Str.A)									1															1
Level 3 (Str.B)			1										1											2
Level 4 (Str.B)																								0
Floor													1											1
All Levels																10								10
TOTAL	1		1						1			1	3			10								17



0S 5E
B'
Bedrock outcrop
Metate 623
A
HEARTH
A'
ENTRY
Burned wood
Metate 622
5S 5E
B
B'
Floor
Bedrock
0
50
100 cm.
0
50
100 cm.
A
B
C
Bedrock
0
1
2
meters
EFN PINENUT SITE (AZ B:6:44-ASM)
FEATURE I, ROOM E PLAN & PROFILE
A: Limestone Rubble
B: Carbon-rich loamy sand with angular limestone fragments.
C: Blackish-gray ashy soil with burned wood pieces.
Vertical slabs

Figure 5.15. Feature 1-Room E: Plan and Profile.

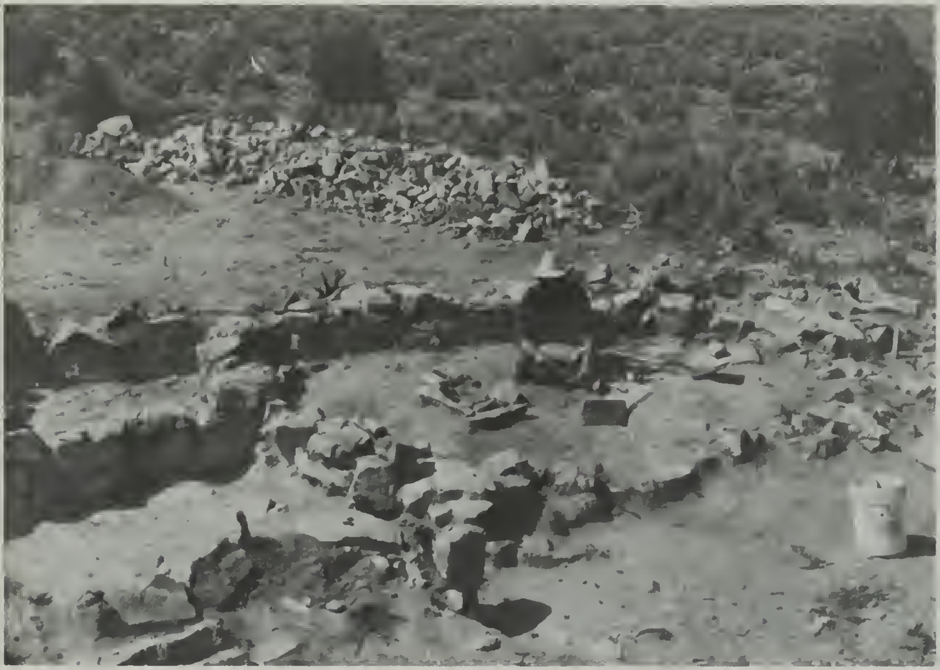


Figure 5.16. Feature 1-Room E, general overview to the northwest. The figure is seated near the central firehearth. Rubble mound in rear consists of the collapsed upper walls of Feature 1 removed for excavation. Room D is to the left rear and Room C is in the left foreground.

Along the west and south walls, the lower footing blocks were topped with a single course of horizontal slabs and blocks cemented into place with a reddish-brown mud mortar which was also found in quantities in the interior room fill near the remaining walls. This mortar and the abundant rubble in the room's upper fill indicate that the upper walls were most likely constructed of horizontal masonry extending one story high.

The roof of Room E was probably constructed of horizontal beams whose ends rested on the tops of the upper walls. The beams may have been laid with their long axes north-south, then overlain with a thick coat of clay. Evidence for this type of roof construction was the presence of burned beams, abundant charcoal chunks, and clay on the floor of Room E, and the absence of any interior floor postholes.

The interior fill stratigraphy of Room E was quite straightforward as a consequence of the rapid destruction of the room by fire. Three stratigraphic units were defined: Strata A, B, and C. Stratum A consisted of dense limestone rubble and tan gravelly, sandy loam averaging

0.23 m in thickness. This overlaid Stratum B, a dark, carbon-rich, "greasy," soil with abundant angular limestone fragments and gravel, ranging in thickness from 0.23 m to 0.38 m. Stratum C consisted of dark blackish-gray ashy soil with numerous chunks of burned wood. Two burned beam fragments occurred in this stratum in the southeast quadrant of the room. Put succinctly, Stratum C represents the remains of the burned roof of Room E, along with portions of the upper walls, which collapsed onto the floor.

A slab-lined firehearth, the only interior floor feature in Room E, is situated 1.75 m directly opposite (west) the entryway. The firehearth was prehistorically constructed by excavating a circular pit 9 to 10 cm deep and 50 cm in diameter into the sub-floor fill. The inner perimeter of the pit was then lined with six vertical sandstone slabs and eight smaller slabs were used to line the floor of the pit. The stones had been set to form a square shape and no clay was used to stabilize the stones. The firehearth measured 47 cm north-west, 43 cm east-west, and 23 cm deep from the top of the vertical slabs to the slab-lined floor.

The hearth was excavated by removing the fill from the east half to reveal the stratigraphic profile. The fill was bagged for flotation analysis and one of several charcoal pieces on the floor of the firehearth was collected for radiocarbon dating. The fill was a uniform deposit of dark brown silty clay, similar to that of Stratum B. A composite pollen sample was scraped from the clean face of the profile, after which the remainder of the fill was removed.

Immediately north of the firehearth was a cluster of 12 horizontal sandstone slabs, ranging in size from 15 cm wide by 30 cm long by 5 cm thick to 30 cm wide by 50 cm long by 6 cm thick. Since these were resting on the floor next to the firehearth, it is thought that they may have been used as heating plates, pot rests, or some other culinary function. They may also have been used as general heating stones (Figures 5.17 and 5.18).

Room E: Chronology

Two radiocarbon dates were obtained for Room E. A sample of burned wood from the floor of the firehearth yielded a date of A.D. 1265±60 (Krueger 640: 685±60 B.P.). A second sample collected from a burned beam on the floor southeast of the hearth yielded a date of A.D. 980±80 (Beta 639: 970±80 B.P.). Temporally diagnostic ceramics recovered from the floor of Room E include Moapa Black-on-gray, which has a time span of A.D. 1100 to 1225, and Shinarump Corrugated, which Colton (1952) assigns to the Pueblo III period.

It is felt that the A.D. 980 date is aberrant since it is earlier than the known beginning date of occurrence of Moapa Black-on-gray, and is also at variance with the generally late occurrence of Shinarump Corrugated (Colton 1952). Moreover, radiocarbon dates from other rooms in Feature 1 and also the A.D. 1265 date for Room E cluster around the time span A.D. 1150 to 1250. Hence, the weight the evidence supports the acceptance of the A.D. 1265 date and rejection of the A.D. 980 date.

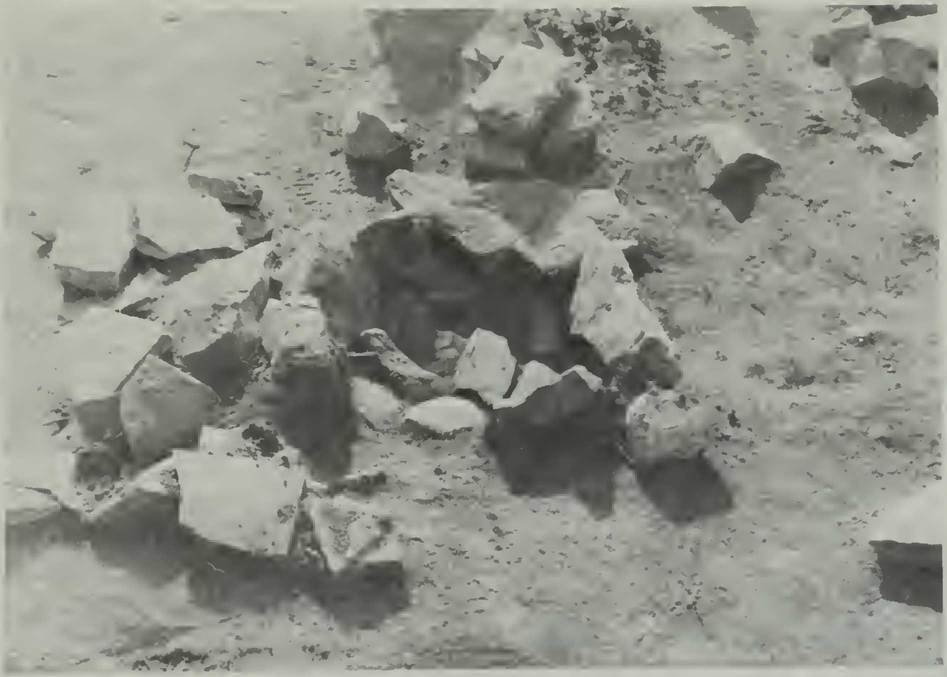


Figure 5.17. Feature 1-Room E, firehearth, showing flat slabs on floor exterior to hearth, view east.

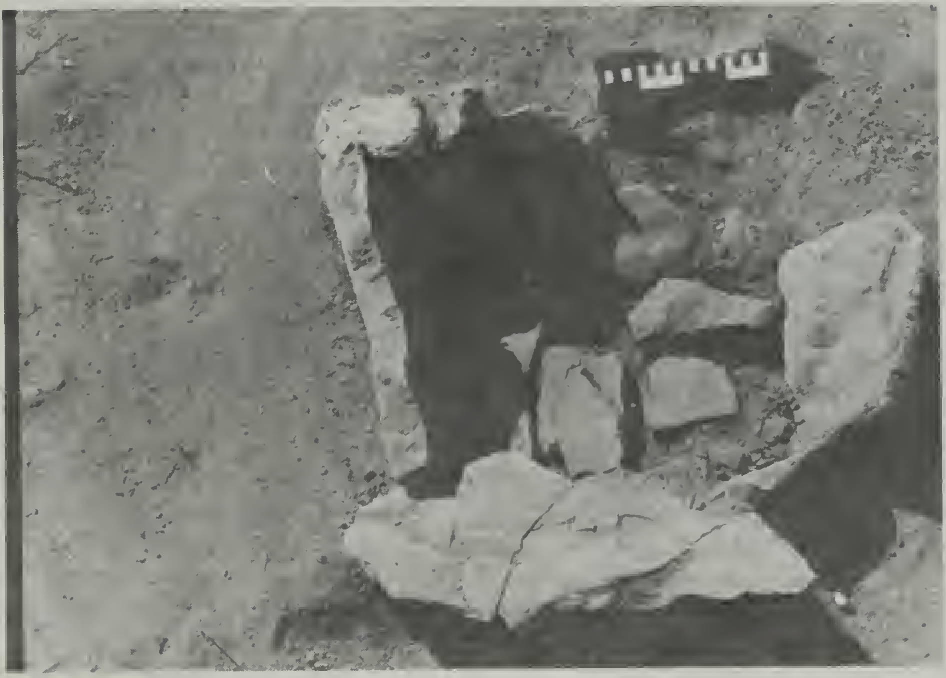


Figure 5.18. Feature 1-Room E, close-up of firehearth after excavation, view west.

Room E: Artifacts

Artifacts recovered from Room E are summarized in Tables 5.9 and 5.10.

Room E: Subsistence Data

Six pollen samples were collected from six different localities in Room E to obtain a detailed reconstruction of plant species that were processed in Room E. Two samples were scraped from the floor directly beneath Metates 622 and 623, respectively; a third sample was scraped from the floor directly beneath the concentrated slabs north of the firehearth; pollen washes were collected from the grinding surfaces of Metates 622 and 623 for the respective fourth and fifth samples; and the sixth sample was collected from the deposit immediately outside the entryway.

The pollen spectrum for the entryway sample is similar to those for the storage rooms in terms of relative frequencies of economic plant species. Economic species include Cheno-ams (_Chenopodium_, goosefoot, and _Amaranthus_, pigweed), _Typha_, _Zea_, and a relatively high frequency of _Artemisia_. Scott (Chapter IX, this volume) suggests that this representation of economic species might have resulted from processing these plants outside the entryway, although it is also probable that they concentrated here as a result of human traffic in and out of Room E.

Economic species represented in the floor samples included Cheno-ams, _Zea_ (corn), _Typha_ (cattail), _Cleome_ (beeweed), Umbelliferae (parsley family), and a large quantity of Gramineae (grass family) pollen was observed in the sample from below the slabs north of the firehearth. The pollen wash from Metate 623 yielded the pollen of _Zea_ and _Typha_, suggesting these species may have been processed on the metate. The wash from Metate 622, however, showed only one economic plant family, Cruciferae (mustard), and Scott cautions that this sample does not show conclusive evidence of grinding foods.

Two flotation samples collected from the firehearth in Room E yielded charred seeds of _Chenopodium_ (goosefoot), _Sphaeralcea_ (globe mallow), _Helianthus_ (sunflower), and an uncharred seed of _Rumex_ (dock) or _Polygonum_ (knotweed).

Lastly, Room E contained the sole evidence of prehistoric faunal bone at the Pinenut Site. Three small fragments of mammalian species were recovered from the floor in the southeast quadrant of the room. Two of the fragments are unidentifiable beyond the family level, while the third may be a leg bone fragment from a cottontail rabbit (_Sylvilagus_ sp.). This fragment was probably split for marrow extraction, but displays no other butchering marks and was not charred (Jacki Montgomery, Abajo Archaeology, personal communication 1987).

TABLE 5.9 . Feature 1 - Room E: Ceramic Type Frequencies.

PROVENIENCE \ WARE / Type	TUSAYAN GRAY WARE & WHITE WARE: VIRGIN SERIES	North Creek Gray	North Creek Corrugated	St. George B/G	Unidentified B/W	B/W Corrugated	SHINARUMP GRAY WARE & WHITE WARE	Shinarump Brown	Shinarump Corrugated	Unidentified B/G	Virgin B/W	Toquerville B/W	MOAPA GRAY WARE & WHITE WARE	Boulder Gray	Moapa Corrugated	Moapa B/G	B/W Corrugated	SAN JUAN RED WARE: LITTLE COLORADO SERIES	Tusayan B/R	TSEGI ORANGE WARE	TOTAL
Level 1 (Strat.B)		1							2					3	1						7
Level 2 (Strat.B)		5	8		4			2	3		1			3	1	1					28
Level 3 (Strat.C)		2	5		2			1	3					6		1		1			21
Floor			6		1				2							1					10
Hearth			1																		1
TOTALS:		8	20		7			3	10		1			12	2	3		1			67

TABLE 5.10 . Feature 1 - Room E: Lithic Artifact Frequencies.

PROVENIENCE \ ARTIFACT TYPE	Projectile Point	Biface	Drill	Notched Tool	Graver	Edge-Abraded Flake Tool	Scraper	Denticulate Tool	Miscellaneous Retouched Flake	Utilized Flake	Core	Hammerstone	Hammerstone Resharpening Flake	Pecking Stone	Hoe/ Digging Implement	Debitage	Mano: 1-hand	Mano: 2-hand	Trough Metate	Grinding Slab	Abrading Stone	Shaftsmoother	Miscellaneous Ground Piece	TOTAL
Level 1 (Str.B)		3					1	1	1	4			1											11
Level 2 (Str.B)						1				3		1	1											6
Level 3 (Str.C)										2				1										3
Level 4 (Str.C)		1					1		1	2	1		2											8
Floor	1	1					1			3	3	3	7	2	1					2	1			25
All Levels																83								83
TOTAL	1	5				1	3	1	2	14	4	4	11	3	1	83				2	1			136

Room F: Description

Room F is the northernmost and smallest component of Feature 1. Unlike the other rectangular storage rooms (e.g., Rooms B, C, and D) Room F is a circular structure, reminiscent of a storage cist.

Roof F was prehistorically constructed by excavating a circular pit approximately 28 cm deep down to hard limestone bedrock in unit 3 of the Harrisburg Member. Irregular limestone rocks were then placed around the inner perimeter of the pit to form a footing for the lower wall stones, then the whole was filled in with reddish-orange clay. Large limestone slabs were vertically mortared onto the footing stones set around the perimeter of the original pit excavation, forming an interior space measuring 1.25 m north-south by 0.90 m east-west. The present depth of Room F is 0.30 m from the top of the encircling lower wall (Figures 5.19 and 5.20).

The lower walls remaining around the perimeter of Room F were partially-collapsed vertical slabs. Since only a minor amount of rubble was found around Room F, it is possible that if the upper walls were constructed of masonry, the blocks may have been taken down for re-use elsewhere during the prehistoric occupation. Alternatively, Room F may have functioned more as a slab-lined cist rather than as a true room. No evidence of an entryway was found and no floor features were present.

The interior fill of Room F consisted of two stratigraphic units. Stratum A consisted of a 30-cm thick deposit of loose grayish-brown sandy loam with occasional limestone cobbles. Underlying this was Stratum B, a 10-cm thick deposit of a reddish-brown compacted clay loam with charcoal flecks and large chunks of burned wood; charcoal was especially concentrated along the northwest quadrant of the room. Stratum B rested directly on the floor surface of Room F.

Room F: Chronology

A sample of burned wood from the charcoal concentration in the northwest quadrant of Room F yielded a radiocarbon date of A.D. 1245 (Krueger 641:705±55 B.P.). This date would place Room F in the middle range of the time scale represented at the Pinenut Site. Support for this date comes from the architectural attributes of Room F. The circular configuration is reminiscent of Pueblo I-Pueblo II circular slab-lined cists which later evolved into arc-shaped series of contiguous, slab-lined and masonry cists (cf. Dalley and McFadden 1985; Walling et al. 1986). Secondly, the floor of Room F was simply filled in with clay. If the well-prepared rock-and-clay floor of Room D is accepted as a later innovation, then the simple clay floor of Room F may reflect an earlier architectural technology.

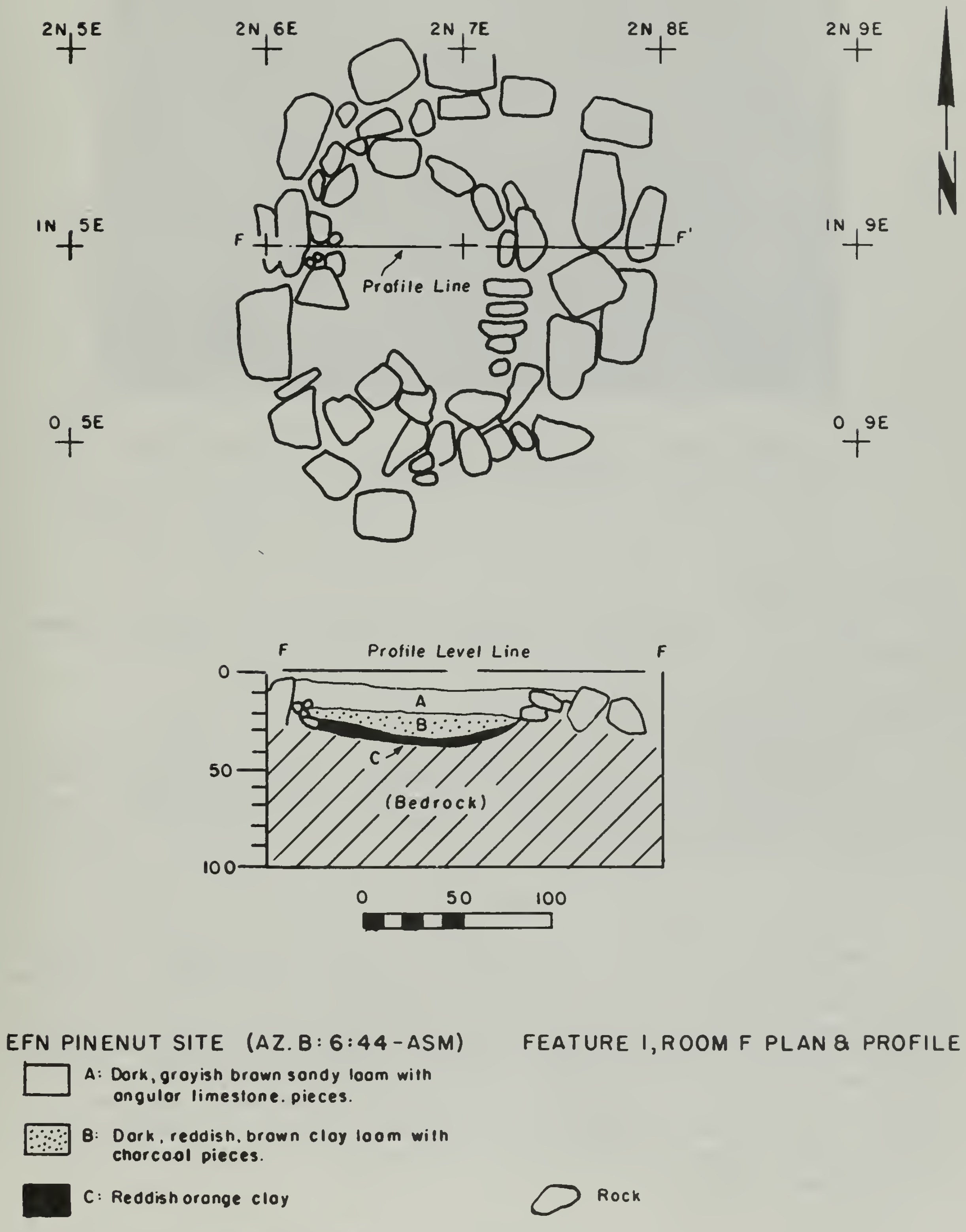

2N 5E
2N 6E
2N 7E
2N 8E
2N 9E
IN 5E
IN 9E
F
F'
Profile Line
0 5E
0 9E
N
F
Profile Level Line
F
0
50
100
A
B
C
(Bedrock)
0
50
100
EFN PINENUT SITE (AZ. B:6:44-ASM)
FEATURE I, ROOM F PLAN & PROFILE
A: Dark, grayish brown sandy loam with angular limestone pieces.
B: Dark, reddish, brown clay loam with charcoal pieces.
C: Reddish orange clay
Rock

Figure 5.19. Feature 1-Room F: Plan and Profile.

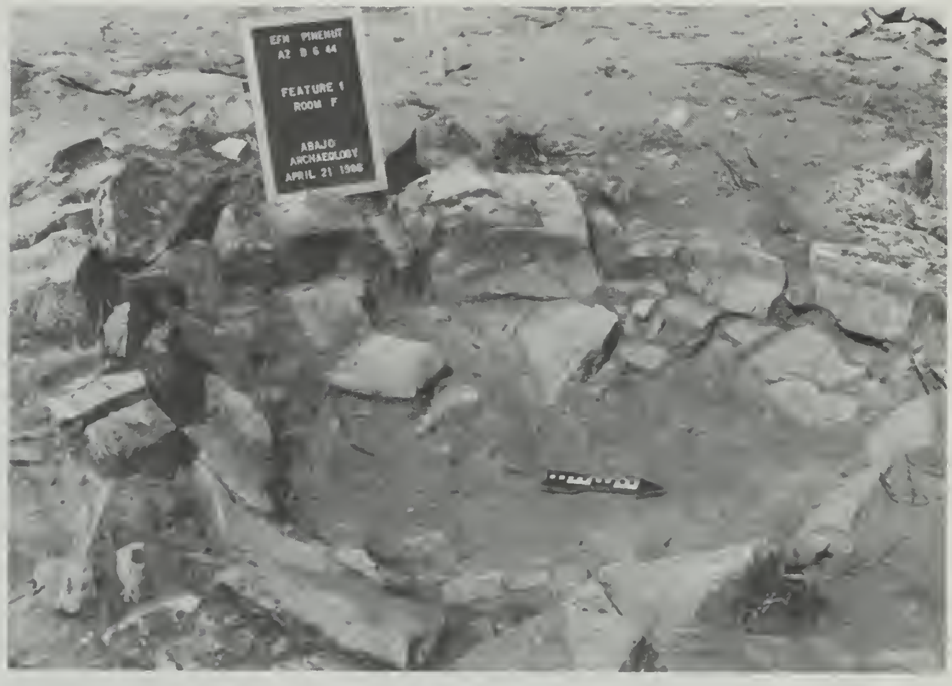


Figure 5.20. Feature 1-Room F: post-excavation photograph, view west.

Room F: Artifacts

Only a few artifacts were recovered from Room F. These are summarized in Tables 5.11 and 5.12.

Room F: Subsistence Data

Pollen Sample 605 collected from the floor surface of Room F displayed small quantities of Zea (corn). Other identified economic species represented in the pollen spectra include Cheno-ams (Chenopodium, goosefoot and Amaranthus, pigweed), Cruciferae (mustard family), and Typha (cattail).

Feature 2

Feature 2 is a pit structure located 8.00 m southeast of Feature 1, the room block. Prior to excavation the pit structure was indicated by a shallow depression encircled by a single course of large limestone blocks and slabs. These encircled an oval area measuring 5.90 m north-south by 5.40 m east-west (Figure 5.21). Subsequent excavation revealed an inner circular pit structure, measuring 3.30 m north-south by 3.70 m east-west, tucked up against the southern perimeter of the encircling blocks; this allowed a bench-like platform north of the pit structure measuring approximately 1.60 m wide (north-south) by 4.45 m long (east-west) (Figure 5.22).

TABLE 5.11 . Feature 1 - Room F: Ceramic Type Frequencies.

WARE / Type PROVENIENCE	TUSAYAN GRAY WARE & WHITE WARE: VIRGIN SERIES	North Creek Gray	North Creek Corrugated	St. George B/G	Unidentified B/W	B/W Corrugated	SHINARUMP GRAY WARE & WHITE WARE	Shinarump Brown	Shinarump Corrugated	Unidentified B/G	Virgin B/W	Toquerville B/W	MOAPA GRAY WARE & WHITE WARE	Boulder Gray	Moapa Corrugated	Moapa B/G	B/W Corrugated	SAN JUAN RED WARE: LITTLE COLORADO SERIES	Tusayan B/R	TSEGI ORANGE WARE	TOTAL
Level 1 (Strat.A)									1					1							2
Level 2 (Strat.A)														1							1
Floor		2	1					2	4					1	2	3					15
TOTALS:		2	1					2	5					3	2	3			--		18

TABLE 5.12 . Feature 1 - Room F: Lithic Artifact Frequencies.

ARTIFACT TYPE PROVENIENCE	Projectile Point	Biface	Drill	Notched Tool	Graver	Edge-Abraded Flake Tool	Scraper	Denticulate Tool	Miscellaneous Retouched Flake	Utilized Flake	Core	Hammerstone	Hammerstone Resharpening Flake	Pecking Stone	Hoe/ Digging Implement	Debitage	Mano: 1-hand	Mano: 2-hand	Trough Metate	Grinding Slab	Abrading Stone	Shaftsmoother	Miscellaneous Ground Piece	TOTAL
Level 1 (Str.A)	1																							1
Level 2 (Str.A)																								0
Level 3 (Str.B)																								0
Level 4 (Str.B)																							1	1
Floor																								0
All Levels																1								1
TOTAL	1															1							1	3

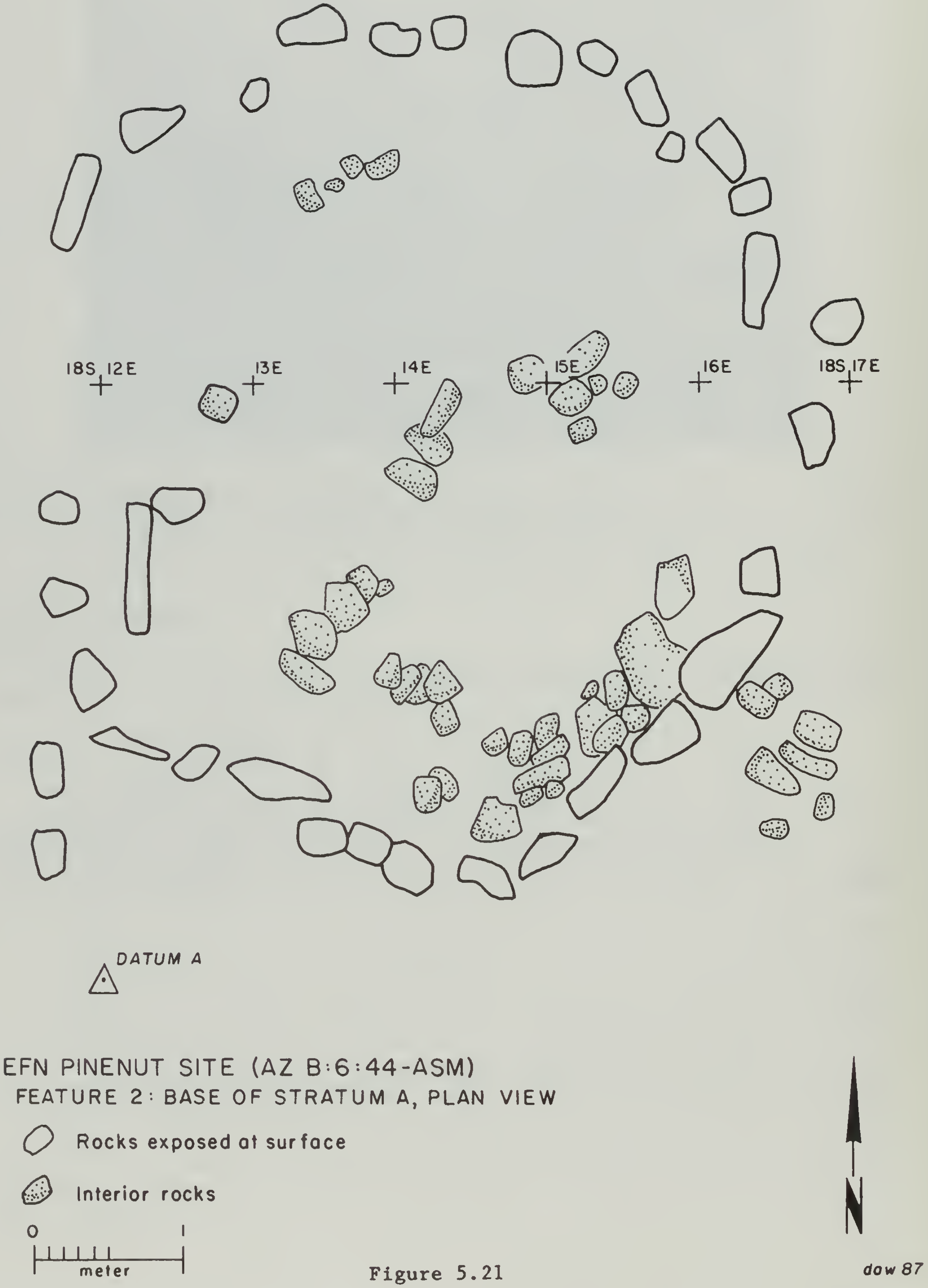

18S 12E
13E
14E
15E
16E
18S 17E
DATUM A
EFN PINENUT SITE (AZ B:6:44-ASM)
FEATURE 2: BASE OF STRATUM A, PLAN VIEW
Rocks exposed at surface
Interior rocks
0
1
meter
N
daw 87

Figure 5.21

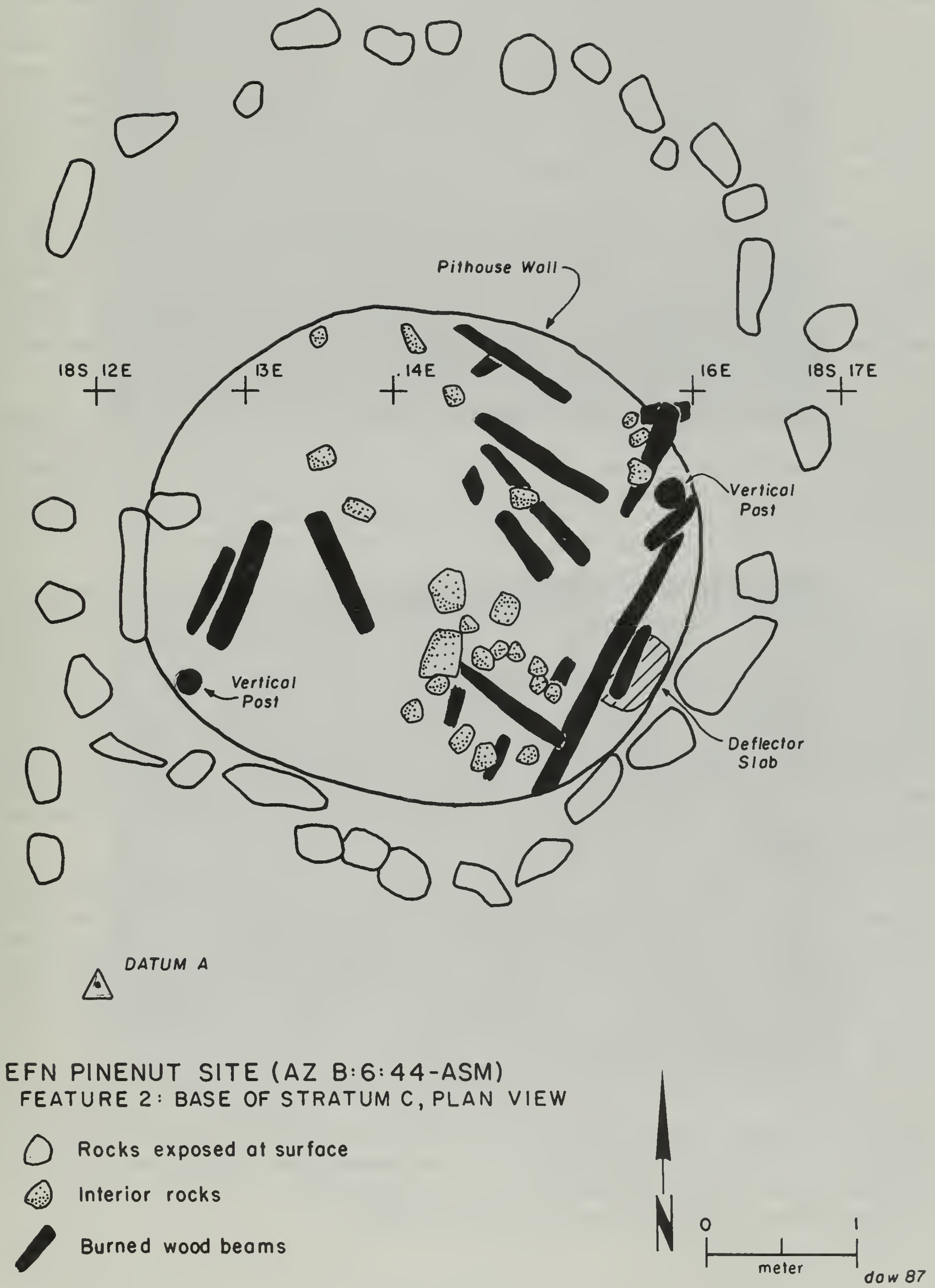

Pithouse Wall
18S 12E
13E
14E
16E
18S 17E
Vertical Post
Vertical Post
Deflector Slab
DATUM A
EFN PINENUT SITE (AZ B:6:44-ASM)
FEATURE 2: BASE OF STRATUM C, PLAN VIEW
Rocks exposed at surface
Interior rocks
Burned wood beams
N
0
1
meter
dow 87

Figure 5.22

Feature 2 was prehistorically excavated into the soft limestone and sandy siltstone of unit 3 of the Harrisburg Member, to a depth ranging from 0.96 m BPGS at the eastern wall to 1.02 m BPGS at the western wall. The interbedded soft and hard limestones of unit 3 provided the prehistoric builders a relatively easy-to-excavate matrix for the pit structure, and also provided a relatively stable surface for the interior walls. There was scant evidence that the inner walls were plastered, although a thin clay wash was discernible on the upper sections of the walls. A moderate amount of red clay particles was observed in the interior fill near the walls, and it is possible that this red clay might represent an original wall plaster.

The presence of abundant limestone blocks, clay, and burned juniper posts and beams in the interior fill of Feature 2 provided clues for the reconstruction of the upper walls and roof of the pit structure (Figures 5.23 and 5.24). It appears that the limestone blocks were used for a low masonry wall on top of the soft bedrock lower walls of the pit structure; a few large blocks remaining in situ at intervals along the top of the lower walls lend support to this conclusion.

The roof was probably constructed of horizontal juniper beams overlain with a thick coat of clay. The remains of four large upright posts at the respective NW, NE, SE, and SW junctions of the pit structure walls and floor clearly demonstrate a square, four-post roof support system (Figure 5.25). These posts probably supported a flat roof, with the ends of the roof beams resting on the masonry upper walls.

The bench-like platform immediately north of the pit structure is a problematic feature. It is unlike the interior pit house benches reported elsewhere in the Virgin Anasazi region, most notably for the Basketmaker III period (cf. Aikens 1965; Nickens and Kvamme 1978). Benches seem to be generally absent or rare in the Pueblo II period; they are common in Pueblo II Kayenta Anasazi kivas, but are typically highly formalized features. No postholes were found to indicate that some sort of superstructure was placed over this platform; if such was indeed present during the prehistoric occupation, stringers may have been propped against the northern alignment of stones and rested along the roof edge of the pit structure.

The floor of Feature 2 slopes gently westward (Figure 5.26). The hard limestone bedrock floor had been coated with two different clay plasters. The original lower floor plaster was a thin whitish-tan, very fine silty clay with a texture like talc. Above this was a 1-cm thick coat of reddish-orange clay which had been smoothed and slightly polished. This second clay layer occurred only in patchy remnants across the floor and was best preserved in the eastern half of the pit structure.

Six floor features were identified, consisting of five floor pits (Floor Pits A, B, C, D, and E) and a central firehearth (Figure 5.27). The fill of all floor pits was identical, consisting of loose whitish-brown silt and charcoal flecks. The consistent nature of the fill indicates all were stripped of their contents and left to the natural elements when the pit structure was abandoned.

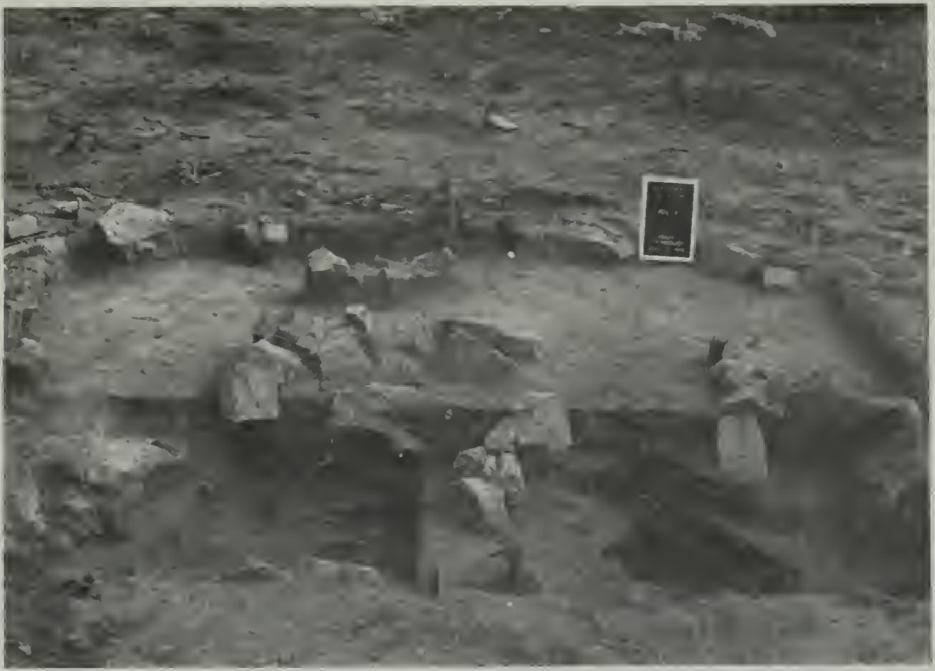


Figure 5.23. Feature 2, showing burned roof posts in fill, view north.

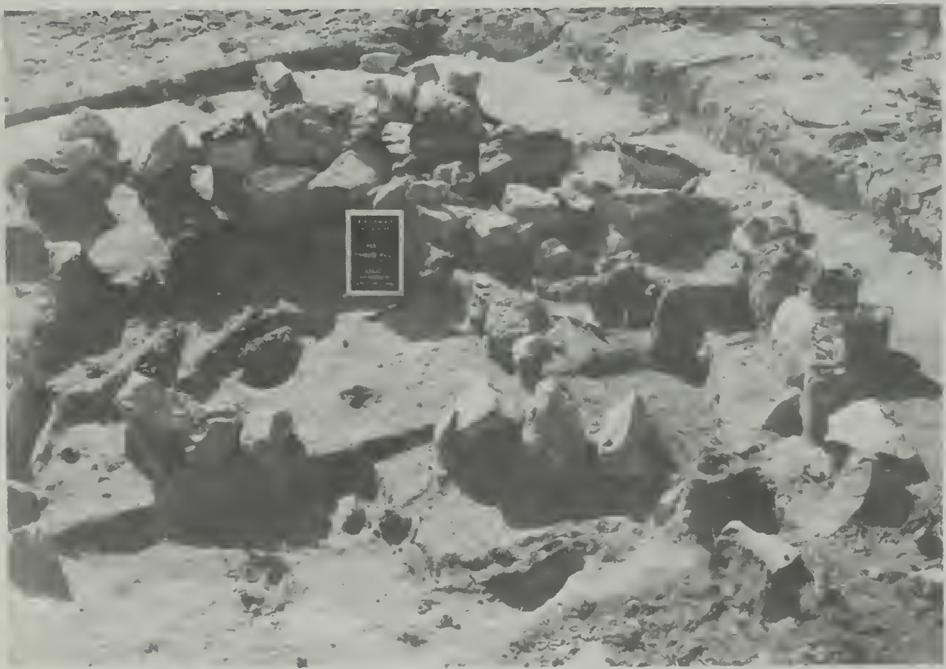


Figure 5.24. Feature 2, showing limestone rubble and burned roof posts in fill, view southeast.

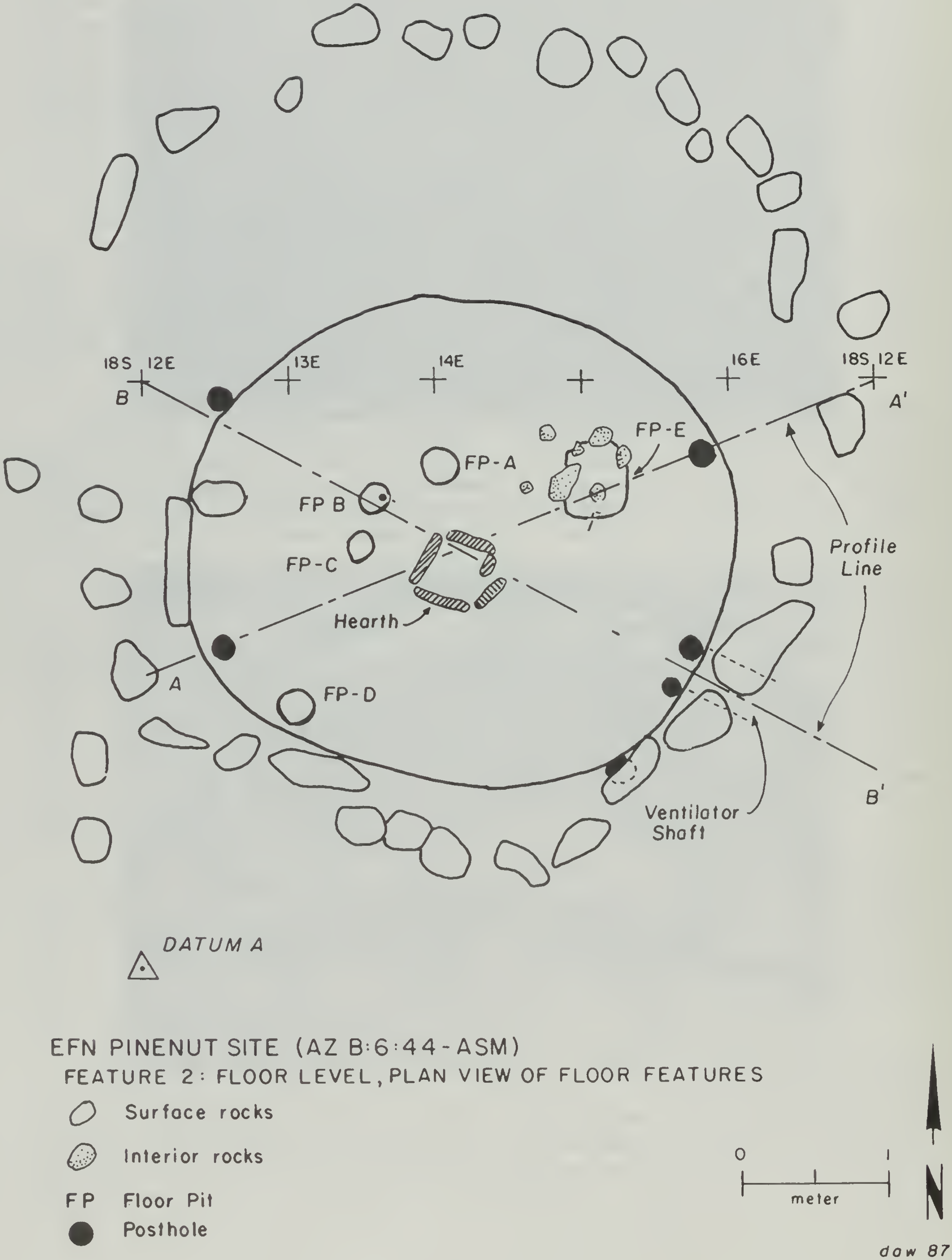

18S 12E
B
13E
14E
16E
18S 12E
A'
FP-A
FP-E
FP B
FP-C
Hearth
Profile Line
A
FP-D
B'
Ventilator Shaft
DATUM A
EFN PINENUT SITE (AZ B:6:44-ASM)
FEATURE 2: FLOOR LEVEL, PLAN VIEW OF FLOOR FEATURES
Surface rocks
Interior rocks
FP Floor Pit
Posthole
0
1
meter
N
dow 87

Figure 5.25

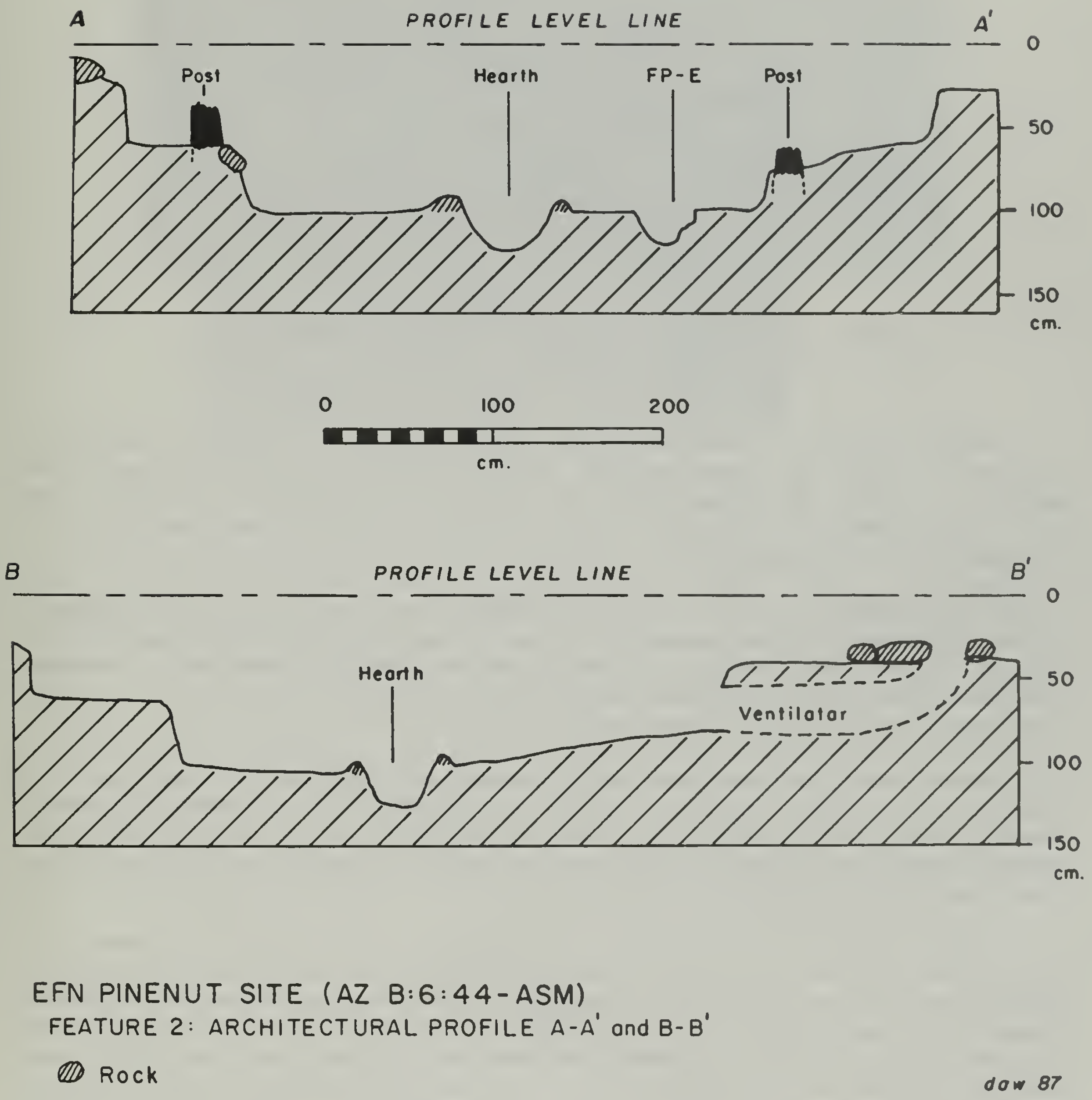


Figure 5.26. Feature 2: Floor profiles.

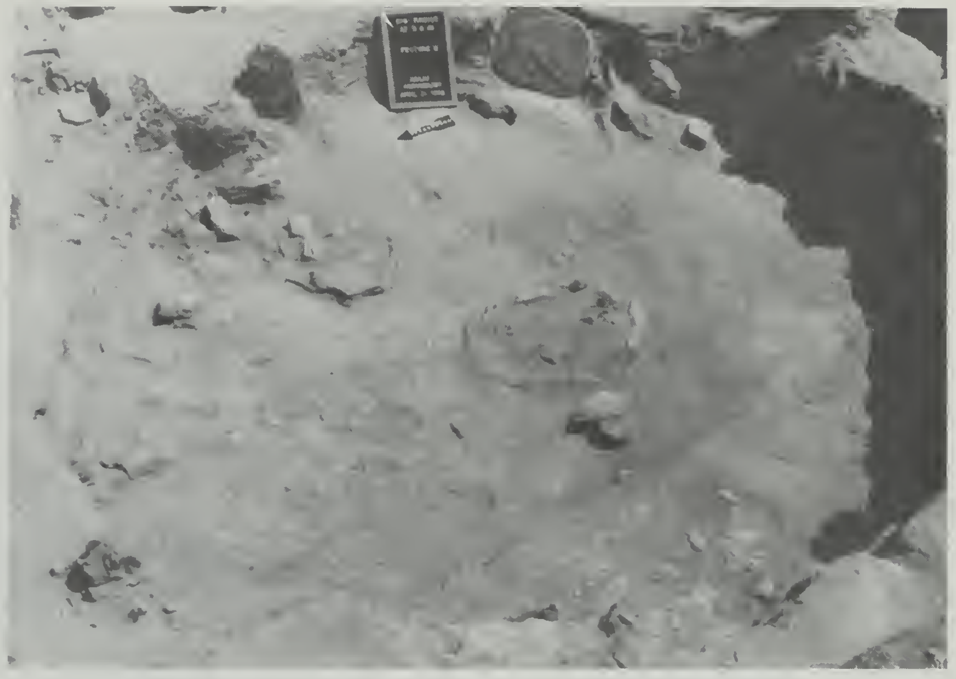


Figure 5.27. Feature 2, post-excavation photograph, view southeast.

Floor Pit A is located 70 cm north of the firehearth. It is a shallow circular pit measuring 20 cm in diameter and 4 cm deep. The walls are straight-sided and the bottom bowl-shaped. This pit may have functioned as a support for a pottery vessel in conjunction with the use of the firehearth.

Floor Pits B and C are two small pits located 40 cm northwest of the firehearth. Both measure 10 cm in diameter and 5 cm deep, respectively. They are situated 21 cm apart and are believed to be ladder post sockets. Their position would indicate an entry through a central smoke hole in the roof of the pit structure.

Floor Pit D had been greatly disturbed and damaged by rodent burrowing, so that its original shape is unknown. It is located against the southeast wall, 1.40 m from the central firehearth. In its disturbed state, Floor Pit D measures 20 cm in overall diameter and 10 cm deep. The function of this pit is not known.

Floor Pit E is located 1.10 m northeast of the central firehearth. It is the largest floor pit, sub-rectangular in outline and measuring 40 cm long, 32 cm wide and 17 cm deep. The interior walls are slightly undercut 2 cm to create a bell-shaped interior. Floor Pit E had been covered by a flat rectangular sandstone slab, which was shattered into several pieces by the collapse of a burned roof support post directly onto it. Reconstruction of the pieces showed the slab measured 38 cm long, 36 cm wide, and 1.5 cm thick (Figure 5.28).

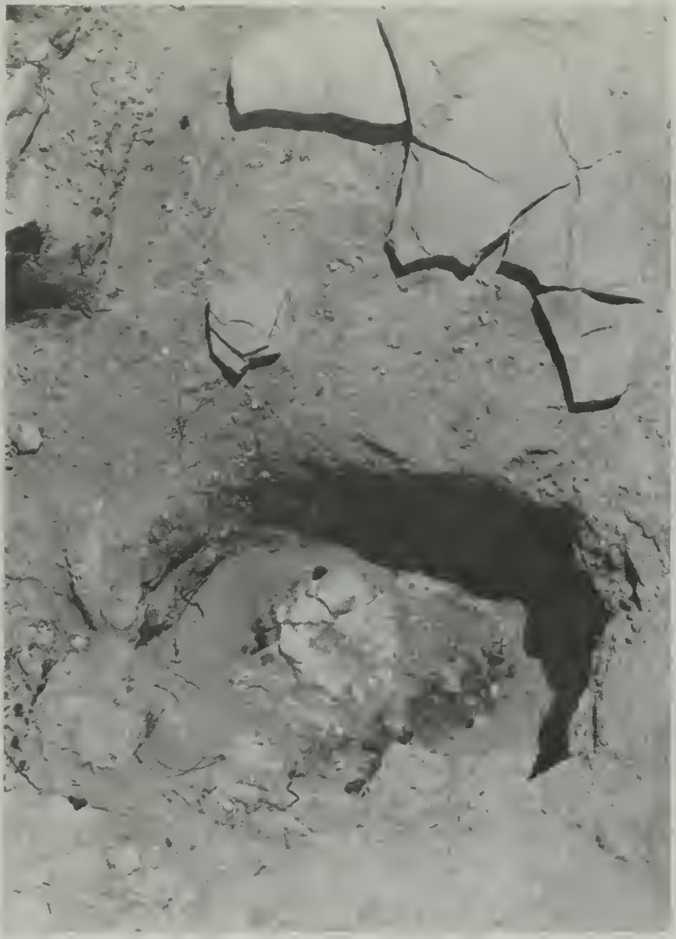


Figure 5.28. Feature 2, Floor Pit E.

The central firehearth is a rectangular slab-lined feature excavated into the central area of the pit house floor (Figure 5.29). The hearth walls slope inward toward the bottom so that the upper dimensions are quite larger than the lower dimensions. The firehearth was prehistorically constructed by excavating an oval pit into the soft limestone of unit 3 of the Harrisburg Member. The pit measures 60 cm NE-SW, 54 cm NW-SE, and 22 cm deep. The interior walls were then lined with five sandstone slabs: one each on the north, west, and south, and two on the east side. The slabs had been mortared together on the interior, and a narrow clay collar encircled the slabs where they protruded 4 cm to 7 cm above the floor surface. The interior dimensions of the firehearth at the floor surface are 51 cm NE-SW by 40 cm NW-SE, tapering to 38 cm NE-SW by 28 cm NW-SE at the bottom. The firehearth contained a light brownish-gray, charcoal-flecked fine sand with one large piece of burned wood.

The fill and burned wood section did not appear to be associated with the use of the firehearth as a heating pit; rather, the fill is similar to Stratum D fill, and the burned wood section appears to have been deposited at the time the superstructure burned and collapsed. Hence, charcoal pieces occurring on the floor of Feature 2, below Stratum D were collected for an independent test of the radiocarbon date for the firehearth sample.

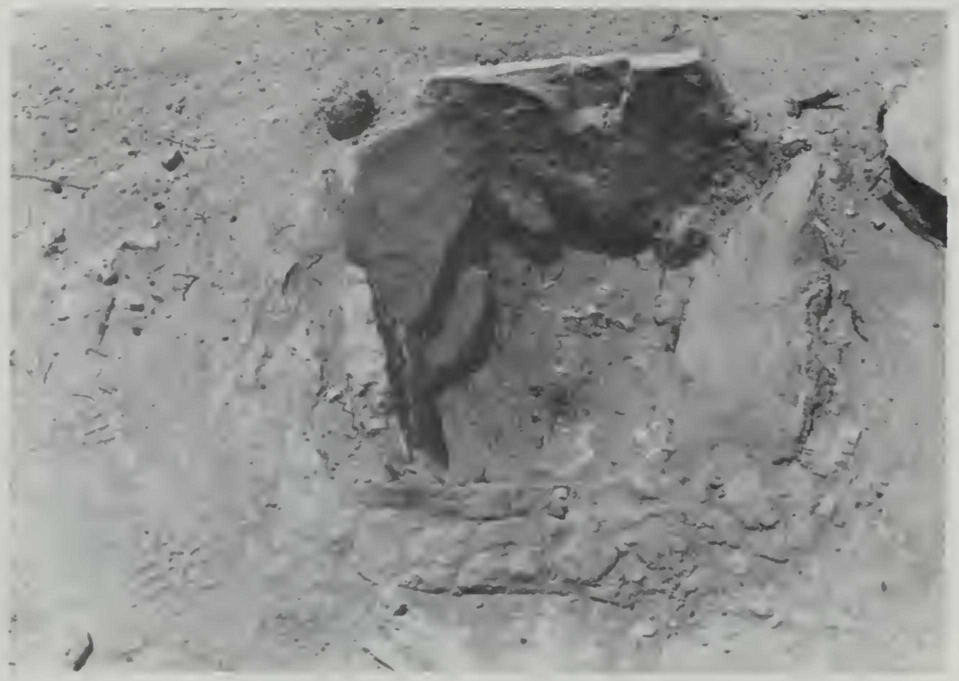


Figure 5.29. Feature 2, central fire hearth.

The ventilator shaft is located at the base of the eastern wall of the pit structure (Figure 5.30). The mouth of the shaft is a 32-cm diameter opening incised into the wall and was plastered with a reddish-brown clay. The ventilator shaft which is unlined, is straight-sided and the floor slopes upwards to the ground surface for a distance of 1.50 m. The remnants of a small coursed masonry wall occur at the location of the ground opening; this appears to have been two courses high and approximately 70 cm long. This low wall probably functioned as a minor windbreak.

A nicely-pecked and shaped sub-rectangular limestone slab was found in a horizontal position directly in front of the ventilator mouth. This was undoubtedly the ventilator draft deflector. In addition, two postholes were located in front of the ventilator mouth; the north posthole is 9 cm in diameter, the south posthole is 8 cm in diameter, and the two are 28 cm apart. It is likely that two short posts were placed here to support the draft deflector in a vertical position in front of the ventilator mouth.

Lastly, a small wall pit or niche was found 7 cm south of the ventilator mouth. The niche is a circular pit 20 cm in diameter and extends 12 cm into the wall. The northern interior wall had been plastered with a reddish-brown clay similar to that used to plaster the ventilator mouth opening. Two small upright slabs were found set into the niche; the function of this small wall feature is not known.

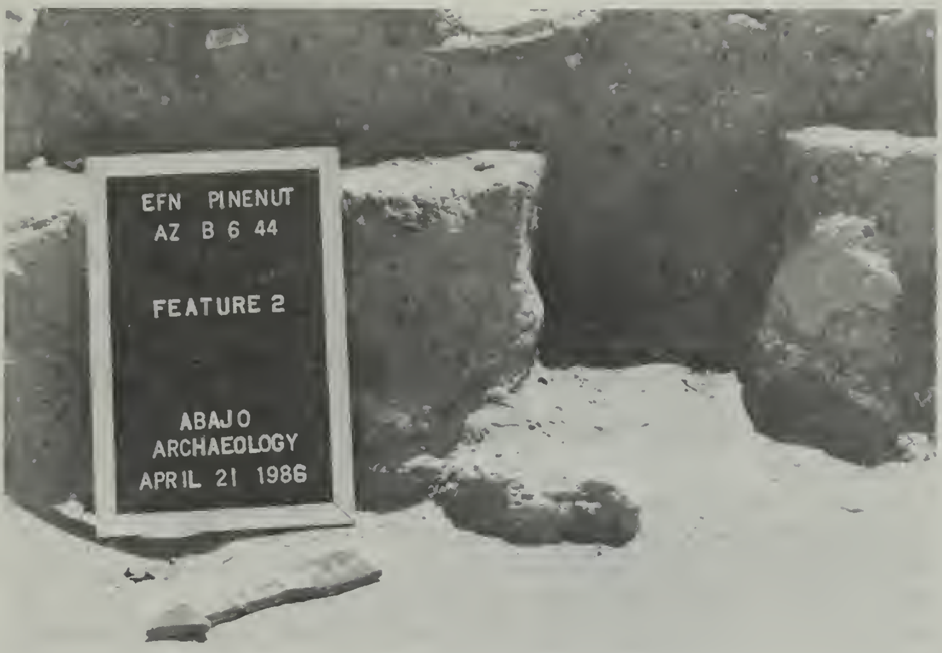


Figure 5.30. Feature 2, close-up of ventilator shaft in east wall.

The interior fill stratigraphy of Feature 2 revealed a history of abandonment, gradual deterioration, collapse, and burning of the pit structure over time. Four distinct stratigraphic units were defined: Strata A, B, C, and D. As shown in profile, (Figure 5.31) strata dip from west to east due to the downward slope of the ground surface from west to east.

Stratum A was the general topsoil which characterized the site surface: a light brown gravelly, sandy loam averaging 25 cm thick. The relatively greater thickness of this deposit is probably a result of the position of Feature 2 at the base of the ridge slope flanking the site on the southwest. Stratum A overlaid Stratum B, a complex deposit of mixed, collapsed and burned architectual debris and soil. The architectural debris consisted of numerous large angular limestone blocks and fragments, hardened pieces of structural clay, and burned roof and post beams in a matrix of medium-brown clay loam. This deposit ranged in thickness from 15 cm in the west side of the pit structure to 80 cm in the eastern end. Stratum C was an irregular 10-cm to 40-cm thick deposit of pale orangish-brown sandy clay with charcoal flecks; this deposit intermingled with Stratum B towards the eastern end of the pit structure and is believed to be the remains of a clay roof. Lastly, Stratum D, resting on the floor of the pit structure, was a light brownish-gray fine sand with charcoal flecks and pieces of hardened clay, ranging in thickness from 1 cm to 60 cm.

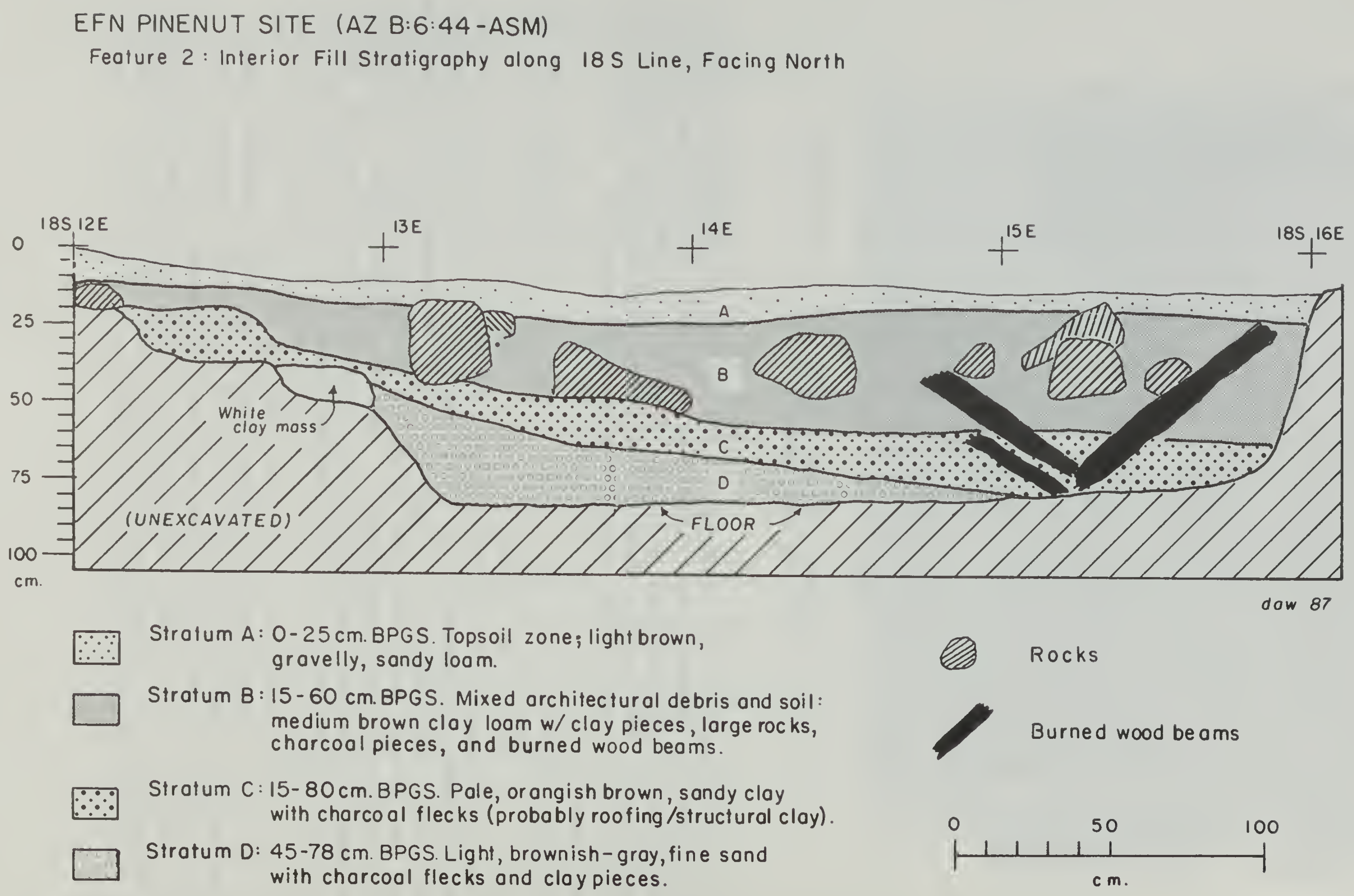

EFN PINENUT SITE (AZ B:6:44-ASM)
Feature 2: Interior Fill Stratigraphy along 18S Line, Facing North
18S 12E
13E
14E
15E
18S 16E
0
25
50
75
100
cm.
A
B
C
D
White clay mass
(UNEXCAVATED)
FLOOR
daw 87
Stratum A: 0-25 cm. BPGS. Topsoil zone; light brown, gravelly, sandy loam.
Stratum B: 15-60 cm. BPGS. Mixed architectural debris and soil: medium brown clay loam w/ clay pieces, large rocks, charcoal pieces, and burned wood beams.
Stratum C: 15-80 cm. BPGS. Pale, orangish brown, sandy clay with charcoal flecks (probably roofing/structural clay).
Stratum D: 45-78 cm. BPGS. Light, brownish-gray, fine sand with charcoal flecks and clay pieces.
Rocks
Burned wood beams
0
50
100
cm.

Figure 5.31. Feature 2: Interior Fill Stratigraphy.

From this stratigraphic sequence it can be seen that Feature 2 was abandoned and allowed to deteriorate. The lowermost Stratum D represents a gradual in-filling of the pit structure by natural depositional processes and structural decay. Some time later, the upper masonry walls and roof caved in, a process that was accelerated by fire, as indicated by the substantial burned architectural debris in Stratum B. Finally, natural erosion and deflation of the ridge slope completed the filling-in of the pit structure, leaving exposed only the encircling limestone blocks.

Feature 2: Chronology

Two radiocarbon dates were obtained for Feature 2. A piece of burned wood in the fill of the central firehearth yielded a date of A.D. 1235±55 (Krueger 650: 715±55 B.P.). As noted earlier, this wood piece is believed to have been deposited into the firehearth when the superstructure burned. A burned wood piece on the floor of Feature 2 immediately south of the firehearth yielded a radiocarbon date of A.D. 1090±60 (Beta 637: 860±90 B.P.). Ceramics on the floor of Feature 2 include North Creek Gray (Virgin Series) Moapa Black-on-gray and Moapa Corrugated (Moapa Ware), and Shinarump Brown and Shinarump Corrugated (Shinarump Ware). These ceramic types indicate a temporal span ranging from A.D. 525 to A.D. 1225, or from Basketmaker III to the Pueblo III period (Colton 1952; Thompson 1986:355).

The earlier A.D. 1090 date is probably associated with the first use of Feature 2 as a pit structure around A.D. 1100. The later A.D. 1235 date most likely indicates the final destruction of Feature 2 around the time of final abandonment of the Pinenut Site. The presence of both early and late ceramic types on the floor might be best explained by the re-use of Feature 2 as a trash dump during a later occupation of the site. Rodents may have advantageously exploited this situation and their burrowing habits could have caused artifact displacement between Stratum D and the floor.

Both the earlier and later radiocarbon dates for Feature 2 are consistent with certain dates for Feature 1. There is evidence of an earlier and later occupation in Room A, and an A.D. 1080 date was obtained for Room B. Although no absolute dates are available for Room A, the absence of Shinarump Gray Ware on the lower floor suggests a pre-Pueblo III period occupation. Hence, it is probable that Feature 2 was initially constructed and occupied as a domiciliary pit house, while Room A functioned as an associated storage room-work area and Room B as a storage room. Lastly, additional support for an earlier occupation comes from Feature 3, an isolated slab-lined cist complex located 8 m northwest of Feature 2. No absolute dates could be obtained for Feature 3 due to the paucity of charcoal; however, if isolated (that is, non-contiguous) slab-lined cists are viewed as historical antecedents to the pattern of contiguous slab-lined storage rooms (cf. Aikens 1966), then Feature 3 might be considered antecedent to Feature 1 (the room block) and contemporaneous with Feature 2.

Feature 2: Artifacts

Feature 2 contained a substantial number of ceramic and lithic artifacts (Tables 5.13 and 5.14). As noted, 15 ceramic sherds and 91 stone stone tools were recovered from the floor of Feature 2. However, the occurrence and distribution of floor artifacts are not useful for reconstructing prehistoric activity areas within the pit structure due to disturbance by natural and cultural processes. Be that as it may, the lowermost levels (Stratum D and the floor) contain a substantially lower frequency of artifacts than do Strata A, B, and C. This phenomenon is thought to reflect the secondary use of Feature 2 as a trash dump by the later inhabitants of Feature 1-Room E.

Feature 2: Subsistence Data

Floor features were intensively sampled for pollen and flotation analyses to identify subsistence resources and to determine, if possible, whether Feature 2 functioned as a domicile or as a kiva. Economic plant species represented in the samples are listed below (Scott, Chapter IX, this volume; Van Ness, Chapter X, this volume).

Pollen Sample No.	Provenience	Economic Plant Species	
606	Floor-SW quad	*Artemisia*	(Sagebrush)
		Cheno-ams	(*Chenopodium*-*Amaranthus*)
		Cylindropuntia	(Cholla cactus)
		Shepherdia	(Buffaloberry)
		Solanaceae	(Nightshade family)
		Typha	(Cattail)
		Zea	(Corn)
607	Floor-NE quad	Cheno-ams	(*Chenopodium*-*Amaranthus*)
		Zea	(Corn)
612	Floor-beneath ventilator deflector slab	Cheno-ams	(*Chenopodium*-*Amaranthus*)
		Zea	(Corn)

Flotation Sample No.	Provenience	Economic Plant Species*	
629	Firehearth	*Chenopodium*	(Goosefoot)
		Pinus edulis	(Pinyon pine)
		Zea (Corn)	
630	Firehearth	*Chenopodium*	(Goosefoot)
		Echinocereus	(Hedgehog cactus)
		Physalis	(Groundcherry)
		Pinus edulis	(Pinyon pine)
631	Firehearth	*Chenopodium*	(Goosefoot)
		Pinus edulis	(Pinyon pine)

* Only charred specimens listed.

TABLE 5.13 . Feature 2: Ceramic Type Frequencies.

PROVENIENCE \ WARE / Type	TUSAYAN GRAY WARE & WHITE WARE: VIRGIN SERIES	North Creek Gray	North Creek Corrugated	St. George B/G	Unidentified B/W	B/W Corrugated	SHINARUMP GRAY WARE & WHITE WARE	Shinarump Brown	Shinarump Corrugated	Unidentified B/G	Virgin B/W	Toquerville B/W	MOAPA GRAY WARE & WHITE WARE	Boulder Gray	Moapa Corrugated	Moapa B/G	B/W Corrugated	SAN JUAN RED WARE: LITTLE COLORADO SERIES	Tusayan B/R	TSEGI ORANGE WARE	TOTAL
Level 1 (Strat.A)		7	6		1			7	3					8	2	2		1	1		38
Level 2 (Strat.B)		5	3		2			1	1		1			5							18
Level 3 (Strat.B)		8	4					1	4		1			1							19
Level 4 (Strat.B)		3	1		1				2					2							9
Level 5 (Strat.C)		2	4					4	3	1				3	2						19
Level 6 (Strat.C)		3	3					2	3					1		1					13
Level 7 (Strat.D)		5	1					1	1					1							9
Floor Fill (Strat.D)		1	2						3		1			2							9
Floor		3	1					2	3					1	2	3					15
TOTALS:		37	25		4			18	23	1	3			24	6	6		1	1		149

TABLE 5.14 . Feature 2: Lithic Artifact Frequencies.

PROVENIENCE \ ARTIFACT TYPE	Projectile Point	Biface	Drill	Notched Tool	Graver	Edge-Abraded Flake Tool	Scraper	Denticulate Tool	Miscellaneous Retouched Flake	Utilized Flake	Core	Hammerstone	Hammerstone Resharpening Flake	Pecking Stone	Hoe/ Digging Implement	Debitage	Mano: 1-hand	Mano: 2-hand	Trough Metate	Grinding Slab	Abrading Stone	Shaftsmoother	Miscellaneous Ground Piece	TOTAL
Level 1 (Str.A)	3	8	1	1			1	2	1	14			3											34
Level 2 (Str.B)	1	4							1	2		1												9
Level 3 (Str.B)		4								2	1	3			2									12
Level 4 (Str.B)	1	2					1		2			1												7
Level 5 (Str.C)	1								2	2														5
Level 6 (Str.C)	1	1		1						4	2				1									10
Level 7 (Str.D)										2										1				3
Floor	1						1		1	4	1				3			1						12
TOTAL	8	19	1	2			3	2	7	30	4	5	3		6	403		1		1				494

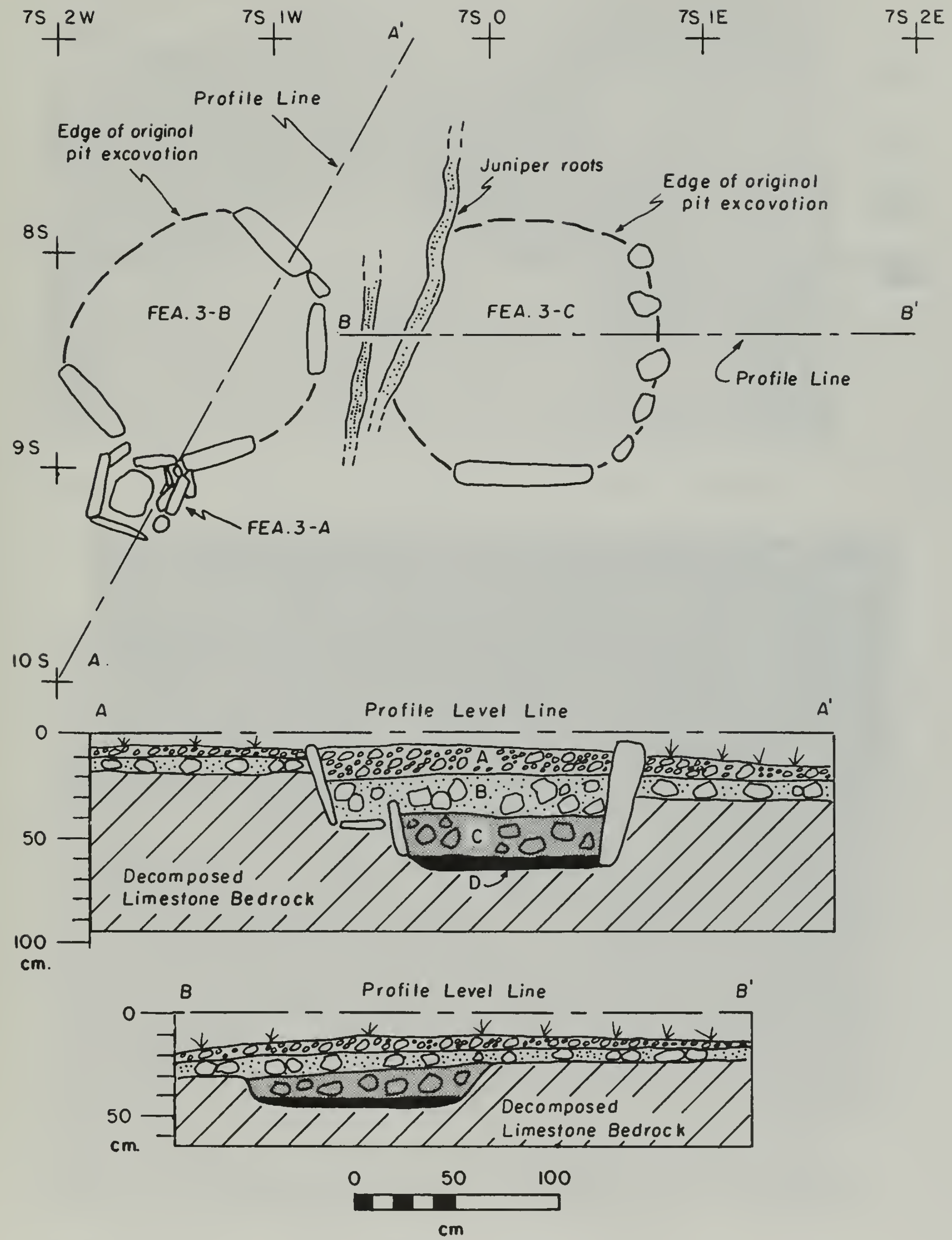
This listing shows that in addition to corn, Feature 2 exhibits a wider range of wild plant species than that represented for any of the rooms in Feature 1. It appears, then, that the earlier inhabitants practiced a mixed subsistence strategy that incorporated horticulture and a relatively larger resource area in contrast to a more restricted resource area as evidenced by the pollen spectra for the later rooms of Feature 1.

Feature 3

Feature 3 is a small complex of circular slab-lined cists located approximately 8.00 m west of Feature 1. Prior to excavation, this complex was indicated by a lone upright limestone slab protruding through a thick mantle of juniper duff. Subsequent stripping of the surface duff around the slab revealed the remains of three slab-lined cists, designated Features 3A, 3B, and 3C, respectively (Figures 5.32 and 5.33). Feature 3A is a small cist appended to the larger Feature 3B cist (Figure 5.34); the two might be considered a single architectural unit. Feature 3C is a nearly totally-dismantled cist with only one vertical slab remaining; it is possible that Feature 3C is an earlier cist, which may have been cannibalized to construct Feature 3B (Figure 5.35). Hence, the features will be described in this presumed chronological order.

Feature 3C was originally constructed by excavating a shallow circular pit approximately 1.20 m in diameter and 6 cm deep into the soft limestone of unit 3 of the Harrisburg Member. The floor of the pit was then filled in with a 3-cm thick layer of dense light brown clay. A large limestone slab measuring 36 cm high, 47 cm wide, and 10 cm thick was set into the clay at the southern perimeter of the original pit excavation, and several other, but smaller, limestone slabs were placed along the eastern perimeter of the pit. It is likely that additional large vertical slabs were set around the entire perimeter of the pit, and that these smaller slabs were used to stabilize the vertical slab footings.

The interior fill stratigraphy of Feature 3C consisted of three depositional units designated Strata A, B, and C, respectively. Stratum A consisted of densely-packed limestone gravels in a brown sandy loam matrix averaging 6 cm thick; this is similar to the general topsoil zone occurring throughout the surface of the Pinenut Site. Stratum B was a deposit of loose light-brown sandy loam with abundant fist-sized limestone cobbles ranging from 6 to 7 cm in thickness. Stratum C was a compacted, reddish-brown clay loam with numerous angular limestone cobbles ranging from 7 cm to 17 cm in thickness. It is suspected that the upper surface of Stratum C might represent a second floor laid down atop the earlier floor represented by the distinct, light-brown dense clay plastered over the soft limestone base of the original pit excavation.



EFN PINENUT SITE (AZ B:6:44-ASM) FEATURE 3, PLAN & PROFILE

Figure 5.32

EFN PINENUT SITE (AZ B:6:44-ASM) FEATURE 3 PLAN& PROFILE

Key to Figure 5.32

▩ A. Densely packed limestone gravels in brown sandy loam matrix.

▒ B. Loose, light brown sandy loam with fist sized limestone cobbles.

▨ C. Compacted, reddish brown clay loam with numerous angular limestone cobbles.

■ D. Floor: Densely compacted light brown clay.

▯○ Wall slabs and rocks

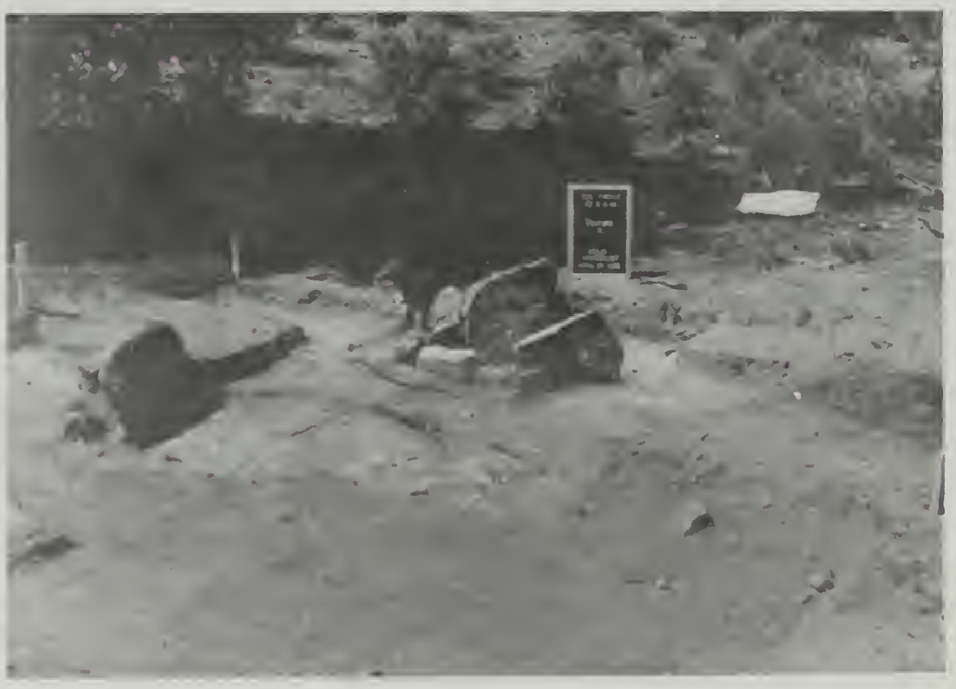


Figure 5.33. Feature 3 Complex. Features 3A and 3B are in the rear and Feature 3C is in the foreground. View is to the southwest.

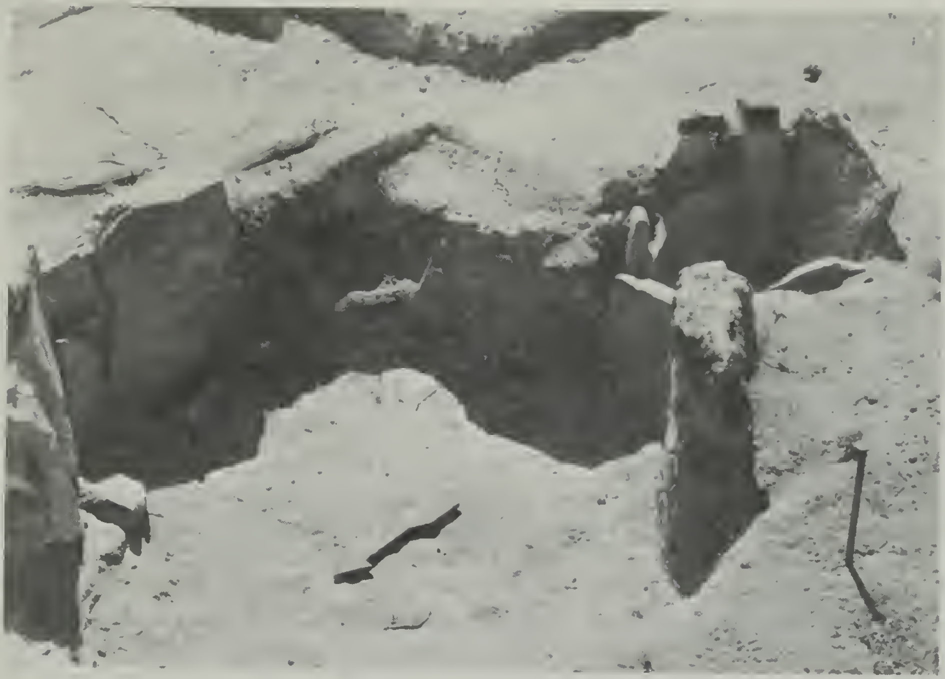


FIGURE 5.34. Feature 3A (right) and 3B (left), viewed to the southeast.

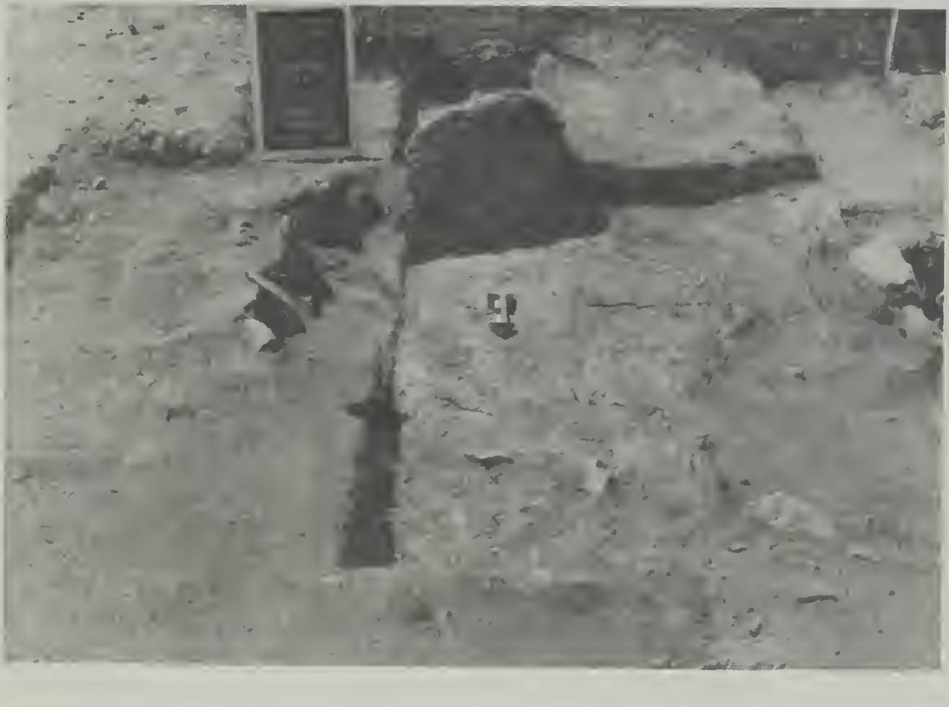


FIGURE 5.35. Feature 3C, viewed to the south. A section of the upper floor zone is shown to the left of the north arrow.

Features 3A and 3B are situated immediately west and adjacent to Feature 3C. The prehistoric construction of Feature 3B is nearly identical to that of Feature 3C, with the addition of a smaller cist (Feature 3A) to the southern edge. The two are described here as a single architectural unit.

Feature 3B was prehistorically constructed by excavating an oval pit 80 cm NE-SW by 70 cm NW-SE and 37 cm deep into the soft limestone of unit 3 of the Harrisburg Member. The floor of the pit was inlaid with a layer of light brown clay averaging 5 cm thick, identical to that used in Feature 3C. Large limestone slabs were then set vertically into this clay around the inner perimeter of the pit. Five large slabs remained on the northeast and southwest sides, respectively; these range in size from 20 cm long by 25 cm wide by 6 cm thick to 52 cm long by 50 cm wide by 15 cm thick. The slab walls enclosed an interior space averaging 98 cm in diameter.

The interior fill stratigraphy of Feature 3B was similar to that in Feature 3C, except that the relative thicknesses were greater. Again, as in Feature 3C, it is suspected that Stratum C might be a second floor laid down atop the lower clean clay floor. It is hypothesized that the combination of clay and abundant rocks that formed the matrix of this upper floor may have been intended as a rodent-proofing device, such as reconstructed for the floor of Room D in Feature 1.

Feature 3A also had been prehistorically excavated into the unit 3 limestone bedrock. The original pit was an oval hole measuring 30 cm north-south, 40 cm east-west, and 40 cm deep. A small flat limestone slab was set into the floor of the pit and the inner walls were lined with sandstone slabs on the east, west, and south; the north wall is a common wall with the south wall of Feature 3B. The interior fill of Feature 3A consisted of the same Strata A and B which occurred in Feature 3B.

Feature 3: Chronology

Due to the lack of charcoal directly associated with the prehistoric use of these cists, no absolute dates are available for the Feature 3 complex. No temporally diagnostic artifacts occurred on the respective floors of these cists. Ceramics recovered from the interior fill include Tusayan Gray Ware and White Ware: Virgin Series, Shinarump White Ware (Toquerville Black-on-white), and Moapa Gray Ware and White Ware (Boulder Gray and Moapa Black-on-gray). Toquerville Black-on-white has been considered a Pueblo III type (Colton 1952), while Moapa Black-on-gray has been cross-dated to the period A.D. 1100 to 1225 (Walling et al. 1986). These two types were recovered from Stratum A, the uppermost level and are believed to be associated with the later occupation of the Pinenut Site. However, if isolated slab-lined cists are perceived as an evolutionary antecedent to the contiguous slab-lined storage rooms of the Pueblo I-Pueblo II period, then the Feature 3 complex might be considered a possible late Pueblo I-early Pueblo II component.

Feature 3: Artifacts

As noted, relatively few artifacts were recovered from the Feature 3 complex. These are summarized in Tables 5.15 and 5.16.

Feature 3: Subsistence Data

Pollen samples were collected as floor scrapes from the respective lower floors of all three cists. No economic plant species were identified in the samples from Features 3A and 3B, so no subsistence record is available for these two features. The sample from Feature 3C showed a small quantity of *Zea* pollen and a single grain of Liliaceae (Lily family) pollen (Scott, Chapter IX, this volume). It is possible that the Liliaceae pollen grain may be from *Yucca*, which occurs in the near vicinity of the Pinenut Site. Since so little economic plant pollen was recovered, the record is unable to address which foods may have been stored in the cists, except that corn and possibly yucca may have been stored in Feature 3C.

Feature 4

Feature 4: Description

Feature 4 is the term applied to the sheet trash midden extending east-southeast from Feature 1, the room block.

After removal of sagebrush from the bench, a Cartesian grid of 2-m by 2-m squares was established across the extent of the midden and all surface artifacts occurring within each grid unit were collected. The grid was then subdivided into four equal quadrants (NW, NE, SE, and SW) and one 1-m by 1-m square unit in each quadrant was selected using a random numbers table. These four respective randomly-chosen units were then excavated to obtain a sample of sub-surface artifacts and cross-sectional profiles of the trash midden. These units were excavated in 10-cm intervals down to bedrock and all fill was screened.

As expected, the trash midden exhibited the natural processes of wind deflation. Test Units 4N/22E and 8N/17E were located at the northeastern section of the trash midden and both exhibited identical subsurface stratigraphy. Stratum A consisted of loose dark-brown sandy loam ranging from 5 cm to 12 cm in thickness. Only a few artifacts were recovered. Stratum B consisted of yellowish-brown gravelly, decomposing limestone encountered at a depth 12 cm below the present ground surface. Stratum B was the hard limestone section of unit 3 of the Harrisburg Member and was obviously sterile.

Test Unit 9S/10E was located directly east of Feature 1-Room B. Stratum A consisted of loose brown sandy loam ranging in thickness from 6 to 10 cm. This overlaid the decomposing, gravelly unit 3 limestone also.

TABLE 5.15 . Feature 3: Ceramic Type Frequencies

PROVENIENCE / WARE / Type	TUSAYAN GRAY WARE & WHITE WARE: VIRGIN SERIES	North Creek Gray	North Creek Corrugated	St. George B/G	Unidentified B/W	B/W Corrugated	SHINARUMP GRAY WARE & WHITE WARE	Shinarump Brown	Shinarump Corrugated	Unidentified B/G	Virgin B/W	Toquerville B/W	MOAPA GRAY WARE & WHITE WARE	Boulder Gray	Moapa Corrugated	Moapa B/G	B/W Corrugated	SAN JUAN RED WARE: LITTLE COLORADO SERIES	Tusayan B/R	TSEGI ORANGE WARE	TOTAL
Level 1 (Strat.A)		4	1		3	2						2				2					14
Level 2 (Strat.A)														1							1
Fea. 3-B (Str. B)														3							3
Fea. 3-A (Str. C)		1																			1
TOTALS:		5	1		3	2						2		4		2					19

TABLE 5.16 . Feature 3: Lithic Artifact Frequencies.

PROVENIENCE / ARTIFACT TYPE	Projectile Point	Biface	Drill	Notched Tool	Graver	Edge-Abraded Flake Tool	Scraper	Denticulate Tool	Miscellaneous Retouched Flake	Utilized Flake	Core	Hammerstone	Hammerstone Resharpening Flake	Pecking Stone	Hoe/ Digging Implement	Debitage	Mano: 1-hand	Mano: 2-hand	Trough Metate	Grinding Slab	Abrading Stone	Shaftsmoother	Miscellaneous Ground Piece	TOTAL
Level 1 (Str. A)		2					1		2	7		2	2											16
Fea.3-B interior	1		1																					2
All levels																88								88
TOTAL	1	2	1				1		2	7		2	2			88								106

Lastly, Test Unit 10S/17E was located 7 m northeast of Feature 2. This test unit sampled a greater depth of cultural fill than was present in the previous three test units. Stratum A consisted of a dark brown sandy loam with charcoal flecks ranging in thickness from 12 to 15 cm. A basin metate fragment lying face down was found resting on the basal surface of Stratum A; this was collected for a pollen wash sample. At a depth 15 cm below the present ground surface the sterile decomposing unit 3 limestone was encountered and excavation was terminated.

Feature 4: Chronology

Although pea-sized and smaller pieces of charcoal occurred in the trash midden, none were collected for radiocarbon dating. The deflated condition of the midden ruled out any possibility of obtaining a reliable date. However, diagnostic ceramics in the midden occur in proportions generally similar to those observed for Features 1 and 2. Hence, the midden was no doubt in use during the entire span of the prehistoric occupation at the Pinenut Site.

Feature 4: Artifacts

Artifacts recovered from Feature 4 are summarized in Tables 5.17 and 5.18.

Feature 4: Subsistence Data

Pollen Sample 624 was a wash from the interior basin of a basin metate found in Test Unit 9S/10E. Scott (Chapter IX, this volume) notes that the pollen spectra are similar to those of the modern surface sample, indicating high proportions of arboreal pollen (pinyon pine and juniper), sagebrush pollen, and cheno-ams. The pollen data indicate that during the time of the prehistoric occupation the pinyon-juniper community may have been similar to that of today. A small quantity of Liliaceaepollen was identified, suggesting a member of this plant family (cf. yucca?) may have been collected and discarded within the trash midden.

Summary and Comparison of Site Architectural Attributes

The architectural attributes of the Pinenut Site features exhibit construction techniques similar to those reported for Virgin Anasazi sites reported elsewhere in the region and also for the Kayenta Anasazi architectural tradition. Feature 1, the room block, is characterized by the accretion of rooms generally proceeding along a gentle arc, open to the east. This general layout is typical of Virgin Anasazi settlements and contrasts with the neat, linear-to-angular room alignments of Kayenta Anasazi room blocks and pueblos (cf. Dalley and McFadden 1986; Effland et al. 1981; Schwartz et al. 1980; Schwartz et al. 1981; Shutler 1961; Walling et al. 1986). The dominant building technique represented by Feature 1 employed large angular limestone and sandstone blocks that had been minimally shaped, if at all. These were set vertical-

TABLE 5.17 . Feature 4: Ceramic Type Frequencies.

PROVENIENCE \ WARE / Type	TUSAYAN GRAY WARE & WHITE WARE: VIRGIN SERIES	North Creek Gray	North Creek Corrugated	St. George B/G	Unidentified B/W	B/W Corrugated	SHINARUMP GRAY WARE & WHITE WARE	Shinarump Brown	Shinarump Corrugated	Unidentified B/G	Virgin B/W	Toquerville B/W	MOAPA GRAY WARE & WHITE WARE	Boulder Gray	Moapa Corrugated	Moapa B/G	B/W Corrugated	SAN JUAN RED WARE: LITTLE COLORADO SERIES	Tusayan B/R	TSEGI ORANGE WARE	TOTAL
Surface Collection		52	59	1	20		107	39	4	10			100	32	1	2		3		2	432
Level 1 - Test		4	3		5		6						4	2							24
Level 2 - Test		1						1					1								3
TOTALS:		57	62	1	25		113	40	4	10			105	34	1	2		3		2	459

TABLE 5.18 . Feature 4: Lithic Artifact Frequencies.

PROVENIENCE \ ARTIFACT TYPE	Projectile Point	Biface	Drill	Notched Tool	Graver	Edge-Abraded Flake Tool	Scraper	Denticulate Tool	Miscellaneous Retouched Flake	Utilized Flake	Core	Hammerstone	Hammerstone Resharpening Flake	Pecking Stone	Hoe/ Digging Implement	Debitage	Mano: 1-hand	Mano: 2-hand	Trough Metate	Grinding Slab	Abrading Stone	Shaftsmoother	Miscellaneous Ground Piece	TOTAL
Surface Coll.	10	6	1		2	1	4	2	2	48	2	5	11							2	1		1	98
Level 1 - Test		3								4			1											8
Level 2 - Test		1																						1
All Levels																459								459
TOTAL	10	10	1		2	1	4	2	2	52	2	5	12			459				2	1		1	566

ly around the perimeters of individual rooms to form the basal footings for the upper walls. The upper walls appear to have been horizontally-laid masonry, although remnants of upper wall corners showed that the builders were unfamiliar with masonry corner bonding techniques characteristic of Kayenta Anasazi room block construction. It appears that the upper walls more often abutted each other at the corners and bonding was rarely utilized. The use of vertically-set slabs and blocks, however, is characteristic of Virgin Anasazi architectural technology. Hence, the cumulative evidence shows that the builders of Feature 1 generally followed the Virgin Anasazi architectural tradition.

Feature 2, the pit structure, exhibits attributes that also indicate a Virgin Anasazi technology. The cumulative architectural attributes do not correspond in all respects to other Virgin Anasazi pit structures reported elsewhere, but they do have more in common with these than with comparative Kayenta Anasazi pit structures reported for the region. Early Virgin Anasazi pit structures more often tended to have formal attributes such as an encircling bench, slab-lined interior walls, and formal firepits. In the later periods, benches were rare and interior walls may or may not have been slab-lined. In addition, greater variation in form and internal features occurred in pit structures during the later periods of the Virgin Anasazi temporal span (cf. Aikens 1965; Dalley and McFadden 1986; Shutler 1961; Walling et al. 1986).

Feature 2 is distinguished from pit structures reported for the Virgin River drainage area by the lack of a well-defined bench and the inclusion of a low masonry upper wall encircling the lower earthen wall. The anomalous "platform" extending north from the pit structure might be considered analogous to the "work patios" described for the Kanab Site located on Upper Kanab Creek (Nickens and Kvamme 1981) and also for several sites in the Virgin River area (Dalley and McFadden 1986; Walling et al. 1986); however, these patios more commonly occurred as discrete features rather than being an integral component of a pit structure. Thompson and Thompson (1974) have described a feature at site GC671 located near Tuweep on the North Rim of Grand Canyon that exhibits certain features similar to Feature 2. At site GC671, Structure 1 was a crescentic-shaped rubble mound that encircled a shallow depression, and which was contiguous to a patio (Structure 2) on the east also partially encircled by rubble. Hence, the platform of Feature 2 might have served a similar function. The position of Feature 2 near the east edge of the bench might have conditioned the orientation of the platform (or patio) to the north rather than to the east. Altogether, the cumulative attributes of Feature 2 once again indicate a Virgin Anasazi construction technology; it has little in common with Kayenta Anasazi pit structures of comparable age other than the fundamental use of a pit dwelling for habitation.

Lastly, Feature 3, the slab-lined cist complex exhibits attributes that are common to both the Kayenta and Virgin Anasazi cultures. Simple circular slab-lined cists such as Feature 3C are ubiquitous in both culture areas and are also widely distributed in the eastern Anasazi area. Feature 3A/3B, which consists of a small slab-lined pit appended to a larger slab-lined cist, does not seem to have a counterpart in Kayenta Anasazi sites reported for the region, but similar examples have been described for the Virgin River drainage area near Quail Creek (Walling et al. 1986).

The Construction and Occupation Sequence of the Pinenut Site

Based on temporal and architectural data at least two, possibly three construction episodes are evident at the Pinenut Site. For clarity, the chronological and architectural sequences are graphically shown in Figure 5.36. The first phase of occupation entailed the construction and use of Feature 2 (the pit structure) and Rooms A and B in Feature 1 (the room block). Possibly, Feature 3C, the partially-dismantled slab-lined cist was also constructed as a temporary storage unit during the initial occupation while the larger structures were being built. Based on radiocarbon and ceramic cross-dates, these features were probably built and used during the A.D. 1050 to 1100 interval. Thus, the initial architecture of the Pinenut Site consisted of a pit structure, an isolated slab-lined cist, and a block of two stone rooms. Feature 2 most likely functioned as a domicile, Room B and Feature 3C as storage units, and Room A as an activity area attached to Storage Room B. The limited number of features indicates occupation by a relatively small-sized group, perhaps a single family.

The second construction episode probably occurred during the A.D.- 1200 to 1250/1275 interval. By this time Feature 2 and Room B had been abandoned and allowed to deteriorate. Beginning at the north exterior wall of Room B, Rooms C, E, and possibly Room F were built northwards to form a gently arc-shaped alignment, open to the east. Room E assumed the domicilary function formerly fulfilled by Feature 2; while Room C and possibly the newly built Features 3A and 3B constituted storage units. Room F also may have been used as a storage unit although the relatively crude construction technology and presence of carbon-rich fill suggest it may have functioned as a heating pit. Finally, Room A was re-used as an activity area in a manner similar to that during the earlier occupation. During this time the abandoned pit structure (Feature 2) accumulated a quantity of trash although trash continued to be deposited on the eastern edge of the bench (Feature 4).

In summary, the second occupation of the Pinenut Site included the use of a domicile (Room E), a storage room (Room C), an activity area (Room A), an isolated possible storage feature (Feature 3A and 3C), and an exterior heating pit (Room F). These reflect the use of the same number and type of architectural features on the site as indicated for the earlier occupation, with the addition of a large heating pit. The low incidence of variation in feature function and material culture assemblages for the two occupational episodes suggests that the composition and structure of the second group of site inhabitants was similar to the first group. Group size, however, might have been smaller as shown by the smaller interior living space of Room E (13.0 square meters) in contrast to the larger living space of Feature 2

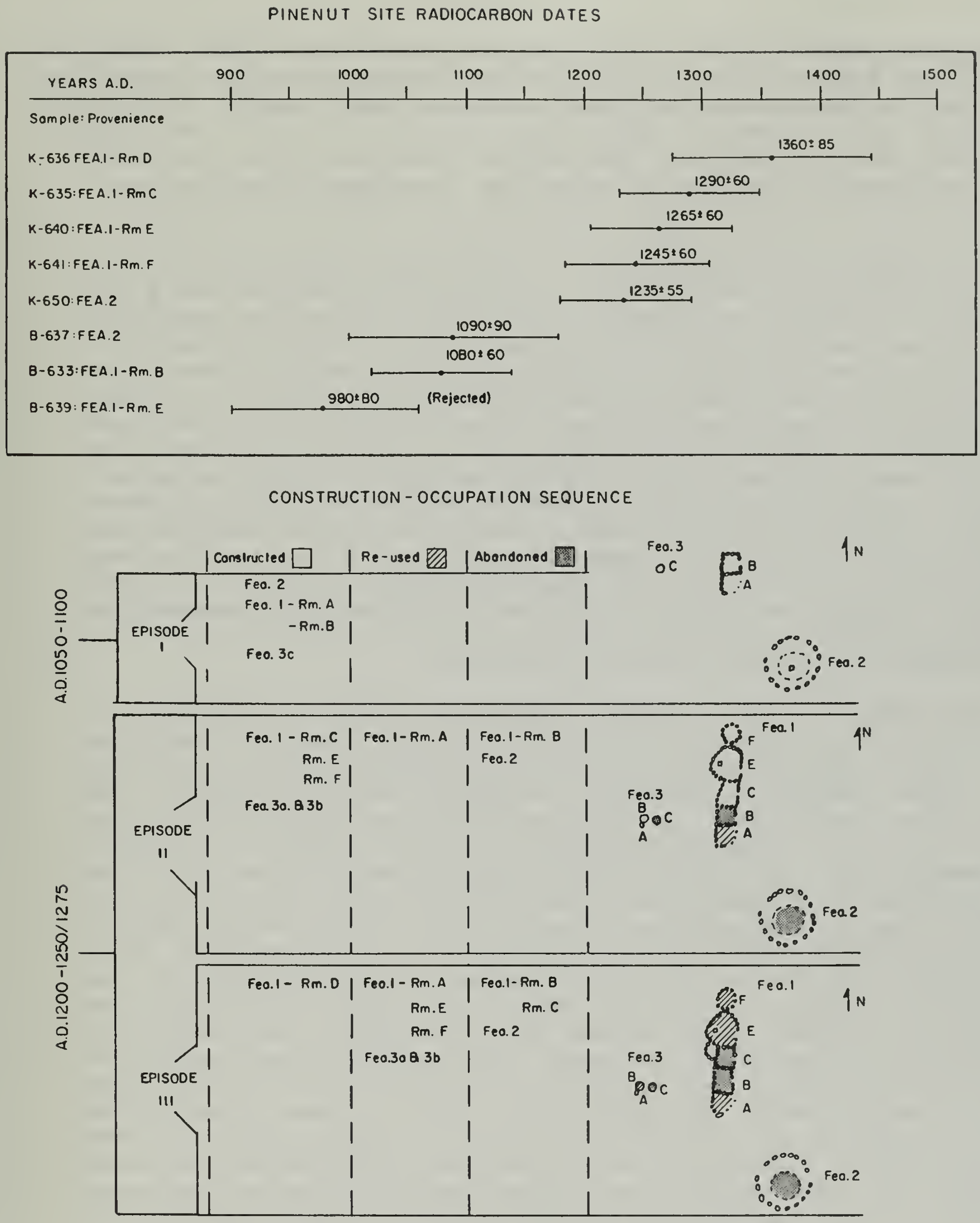


FIGURE 5.36. Chronology and Construction Sequence of the Pinenut Site.

(25.02 square meters). Interestingly, however, the interior floor storage capacity of Room C shows an increase to 4 square meters over the 3 square meters represented for the earlier Storage Room B. Lastly, Feature 3A and 3-B show no significant increase in interior space in comparison with Feature 3C, the earlier slab-lined cist. It would appear that despite a decrease in group size, subsistence-related activities increased to the point where a larger storage capacity was required.

Lastly, Room D represents the third and final architectural construction episode at the Pinenut Site. By this time, Storage Room B had long been in disuse and Storage Room C was cleared and abandoned. Room D reflects an overall greater investment of labor than that manifested by Rooms B and C. The blocks of the enclosing walls of Room D are uniformly massive and closely fitted together, and the floor had been inlaid with a densely-packed layer of cobbles and clay. Sub-floor investigation of Rooms B and C showed that in contrast to Room D, the sub-floor levels of Rooms B and C displayed evidence of rodent burrowing. Obviously, the impervious floor of Room D reflects an effort to thwart potential rodent invasion. Moreover, Room D is further distinguished from Rooms B and C by the apparent absence of an exterior entryway through the wall; access to Room D may have been restricted by a roof entry or through the interior of Room E. In sum, the construction technology of Room D reflects a special effort to protect an important stored resource by limiting access to the room.

Most likely, Room D probably indicates a third re-occupation of the Pinenut Site within the A.D. 1200-1250/1275 interval postulated for the later general occupation of the site. This inference is supported by the high frequency of Shinarump Corrugated ceramics recovered from Room D. The A.D. 1360±85 date is regarded as too late; however, the earlier end of the standard deviation at A.D. 1275 would be acceptable as a terminal date for the final occupational episode of the site. This earlier 85 year span overlaps with the temporal spans of the radiocarbon dates for Room E, Storage Room C, Room F, and the latest end date of the temporal span represented for Feature 2. It is possible, then, that a third occupation may have entailed the re-occupation of Room E again as a domicile, the use of newly-built Room D for storage, and the re-use of Room F as a heating pit. Once again, the composition and structure of the group who built Room D may have been similar to those of the previous two occupations: a small family. Room storage size decreased from a high of 4 square meters in Room C during the second occupation to its lowest point of 1.51 square meters in Room D. This could be interpreted to indicate that the size of the group was smaller than the one who occupied the Pinenut Site during the second episode, or that less surplus food was stored; however, the improved construction techniques and restricted access to Room D would have offset the potential loss of the stored resource(s), thus compensating for decreased storage capacity.

The final abandonment of the Pinenut Site probably occurred around A.D. 1275. This is shown by the overlap of the earliest end of the standard deviation of the A.D. 1360 radiocarbon date from Room D with the latest end of the standard deviation of the A.D. 1080 date from Feature 2, the pit structure. It is possible that the final abandonment of the Pinenut Site was accompanied by the destruction of the site by fire.

CHAPTER VI

CHRONOLOGY OF THE PINENUT SITE

Precise dating of the Pinenut Site was facilitated by radiometric assays of carbonized wood recovered from burned roof elements and floor contexts within features. Burned roof support posts from Feature 2 were submitted to the Laboratory of Tree-Ring Research in hopes of obtaining tree-ring dates; however, these were undatable juniper trunks (Jeffrey S. Dean: personal communication, 1986).

Radiocarbon dates were used to organize construction and occupation episodes at the Pinenut Site in Chapter III (see Figure 5.36). Three general episodes were identified: the first seems to have occurred during the A.D. 1050 to 1100 interval, and the two subsequent episodes occurred during the A.D. 1250/75 interval. These relative sequences are supported by the ceramic data with the exception of the A.D. 980 date for Room E in Feature 1 (see Bond, Chapter VII, this volume). As noted, this early date is from a charcoal sample on the floor of Room E; however, a Moapa Black-on-gray sherd spoon also was found on the floor. Elsewhere, substantial evidence shows that Moapa Black-on-gray occurs no earlier than A.D. 1100. Hence, the A.D. 980 date should be rejected as an aberrant date.

Figure 6.1 shows the relationship of the Pinenut Site radiocarbon dates to other reported dates for the region. Only post-A.D. 900 dates are shown to maintain relevance with the Pinenut Site data. The cluster of earlier dates (A.D. 1080 and A.D. 1090) falls within the range of the middle Pueblo II period of the general Colorado Plateau Anasazi sequence postulated by Euler and others (1979), the Mesa House phase of the central Virgin Anasazi region (Shutler 1961), and the middle Pueblo II Kayenta Anasazi sequence proposed by Ambler (1985). It would therefore appear that the initial occupation of the Pinenut Site occurred in conjunction with the Pueblo II period of Anasazi population growth and expansion on the southern Colorado Plateaus (Dean et al. 1985).

The second cluster of dates which span the interval A.D. 1245-1360 would be considered rather startling in light of the general supposition that the Anasazi had abandoned the Arizona Strip and adjacent Grand Canyon regions around A.D. 1150 (Aikens 1966; Effland et al. 1981; Schwartz et al. 1980; Schwartz et al. 1981; Shutler 1961). However, as shown in Figure 6.1, post-A.D. 1150 radiocarbon dates have been reported for several localities although most investigators are inclined to treat these as too late and therefore aberrant. Be that as it may the cumulative data, together with the strong cluster from the Pinenut Site, might be considered adequate evidence to propose the continued occupation of certain localities by the Anasazi well into the thirteenth century (cf. Effland et al. 1981; Jones 1985; Thompson and Thompson 1974). Water Canyon Point most likely was one such locality that retained its Anasazi population for some time after the general abandonment of the region by large segments of the total population around A.D. 1150.

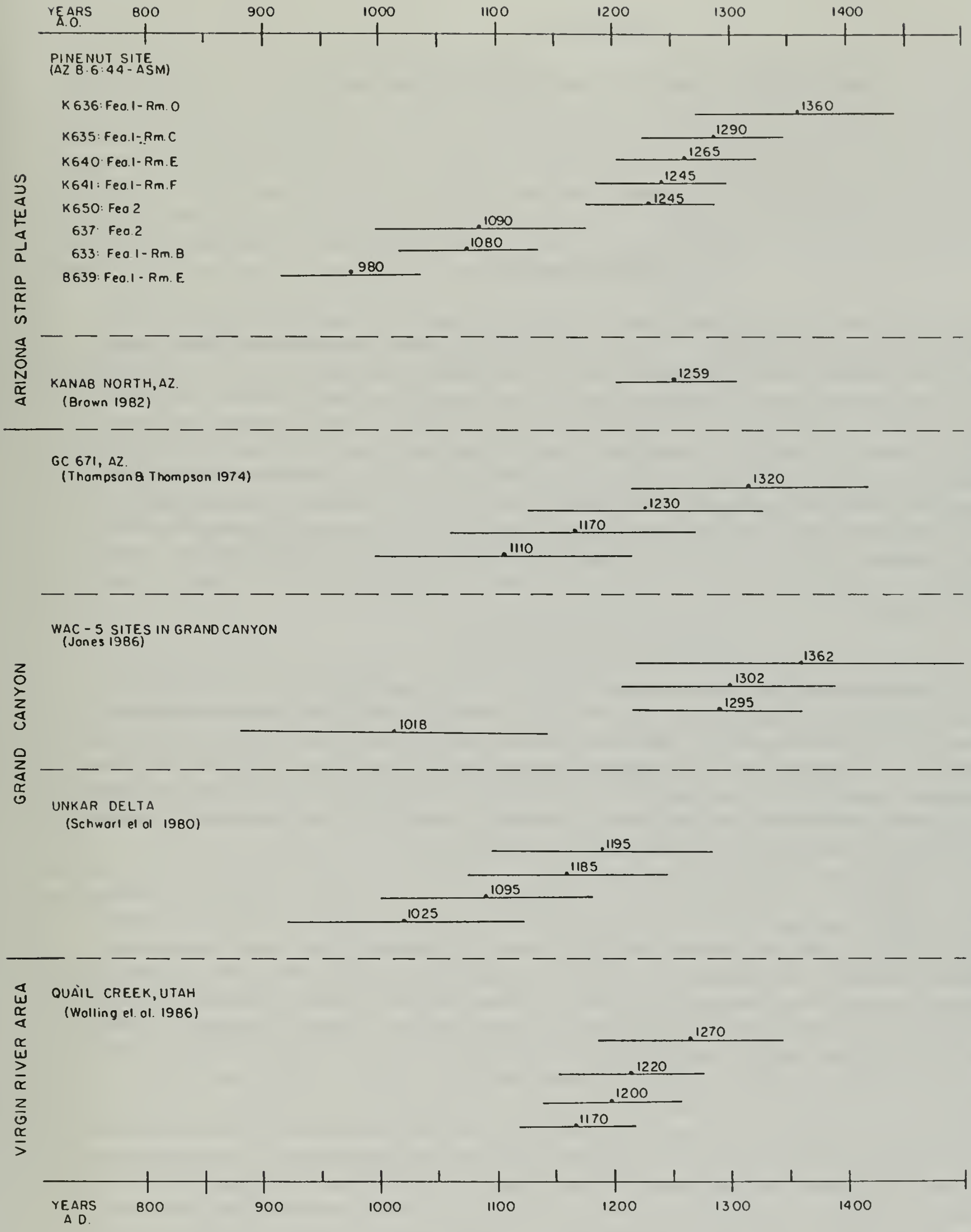


Figure 6.1. Selected regional radiocarbon dates.

CHAPTER VII

ANALYSIS OF CERAMICS FROM THE PINENUT SITE

by

Mark Bond

Introduction

Archaeological excavations at the Pinenut Site (AZ.B:6:44-ASM) resulted in the controlled collection of ceramic artifacts from both surface and subsurface proveniences. The analysis of the 1054 sherds collected provides an opportunity to add data to our slowly growing knowledge of the ceramic technology of the Virgin, or Western Anasazi, as well as providing information concerning use of the Water Canyon Point area by the inhabitants of the Pinenut Site. The ceramic assemblage is described with two objectives in mind: 1) to demonstrate the variability seen within the assemblage, and 2) to promote comparability of the Pinenut Site ceramic assemblage with similar assemblages from the region.

Analysis Methodology

In an assemblage analysis specific attributes exhibited by individual sherds are monitored and tabulated so that observations on the assemblage as a whole can be made. Changes in values recorded for individual attributes or clusters of attributes potentially indicate change within or between typological categories. Hence, those attributes which are monitored must be those which can be easily measured as well as those having value in demonstrating cultural variation.

The existing classification scheme used to order the ceramics of the Virgin Anasazi was presented by Colton (1952). This ceramic typology follows closely that of the Kayenta Anasazi due to his theory of mutual origin. Although it still stands as the basis for ceramic classification in the region, Colton's system has been questioned and modified by more recent investigators (cf. Aikens 1965; Blinman 1986; Geib et al. 1986; McPherson 1978; Moffit and Chang 1975; Nickens and Kvamme 1981; Thompson 1971, 1986; Wilson 1985).

In order to make observations concerning variation between the Pinenut ceramics and those from nearby regional sites, it is necessary to monitor similar attributes in the Pinenut Site assemblage as have been reported in the available literature. Attributes chosen for observation include paste characteristics and temper type, surface compaction and manipulation, surface cover, paint type and design, vessel forms and the presence of post-firing modifications (Appendix I).

Paste and temper observations were made by means of a 20-to-40 power binocular microscope. Variability in the combinations of paste and tempering materials observed form the basis for ceramic ware and series affiliations and, hence, chronological determinations. A small sample of selected sherds was refired to a standardized temperature and oxidizing atmosphere in order to make observations concerning paste composition and clay source variability. Color designations used to describe pastes refer to Munsell Soil Color Charts (1975) notation. Specimens were observed for color in indirect sunlight.

Attributes characterizing surface manipulation and design style aid in refining ceramic types within a ware. This is based on the assumption that regional potters shared basic conceptions of shape and design style and application. Additionally, this implies that changes in these concepts can be observed and temporal associations made. Following Wilson (1985:118) and Blinman (1986:82), terminology defining design style is that of Colton (1955) as established for Tusayan White Ware: Kayenta Series. Only two distinct design types were observed: Sosi Black-on-white and Dogoszhi Black-on-white. Non-distinct but apparent Pueblo II design elements were termed "General Pueblo II." A large class of stylistically indeterminate whiteware sherds, neither Sosi nor Dogoszhi, was recognized due to the small size of the sherds.

Vessel form and post-firing modifications comprise the basis for vessel function inferences. In this case, as no whole vessels were recovered, vessel shape was inferred from certain diagnostic sherd shapes and comparison with established regional literature (cf. Blinman 1986:82-83). The small size of the majority of the sherds collected, as well as the lack of elaborate interior and exterior surface manipulation and ornamentation on some sherds, resulted in a large number of sherds from vessels of indeterminate shape. For the most part these sherds are from grayware vessels. They are included in the appropriate attribute tables.

Analysis was initiated by washing the sherds in water according to Arizona State Museum stipulations. A few sherds with heavy calcium carbonate deposits were briefly soaked in an acid solution, then rinsed in water. During analysis sherds were removed from the sacks and relevant provenience information from each sack recorded on the analysis forms. Each sherd was then examined macroscopically and with the aid of the microscope. Attribute observations were recorded for individual sherds with each analysis form listing the attributes of the sherds from a single sack or provenience. After observation, the sherds from each sack were bagged in small plastic bags, each containing sherds of identical attributes with a slip of paper describing these attributes, and returned to the original field sacks. During the recording of attributes all sherds that could be demonstrated through articulation to belong to a single vessel were counted as one sherd rather than as several individuals. This was done in order to limit the artificial inflation of attribute categories that would result from intentionally monitoring more than one sherd from a single vessel.

Temper and Paste Classification

As originally defined, indigenous ceramics from the Arizona Strip area were classified into two series within the Tusayan Gray Ware and White Ware, Virgin Series and Johnson Series respectively, as well as Shinarump Gray Ware and White Ware, Moapa Gray Ware, and Logandale Gray Ware (Colton 1952). As noted earlier, these wares are presently not completely accepted without various modifications concerning paste, temper, and design attributes (cf. Geib et al. 1986:11-19 for discussion). Bearing in mind these discussions, the Pinenut Site ceramic assemblage analysis placed heavy emphasis on paste and temper characteristics for separation of ware categories.

Tempering Materials

Three major and three minor tempering material classes are represented in the Pinenut Site ceramic assemblage. The three major classes together account for 97% of the total assemblage. The three minor classes each account for 1% or less of the total assemblage.

Tempering material observed in the Pinenut Site ceramic assemblage is heavily weighted towards quartz sand and crushed sandstone. A total of 546 sherds or 52% of the total exhibit a sand or crushed sandstone temper. These appear as abundant small to medium-sized, rounded grains, clear to frosted in color and, in the case of the sandstone, accompanied by small white angular fragments representing the cementing matrix. Aggregates of sand grains still held together by this matrix were commonly observed. Wilson (1985:116) reported an apparently similar temper type for the majority of the Tusayan White Ware: Virgin Series and Shinarump Ware sherds from sites near the Vermilion Cliffs area in Kane County, Utah. In sherds recovered from near Washington City, Utah, Blinman (1986:86-89) noted a similar temper type for the majority of the Virgin Series sherds though it represented only 3.7% of the Shinarump Ware sherds.

Another temper class containing significant amounts of quartz sand is a combination of the sand or sandstone similar to the type described above with the addition of a white-to-gray, opaque, crushed rock of similar dimensions to the sand grains. This rock is angular and appears to have been intentionally reduced mechanically rather than having been collected as an arroyo or stream sand. Relative ratios of sand to rock were not determined although the majority of these sherds appear to contain more rock than sand. This combination sand and crushed rock temper type was observed in 172 sherds or 16% of the total Pinenut assemblage. It appears to be similar to a temper type which accounted for 85.4% of the Shinarump Ware sherds identified by Blinman (1986:86).

The second largest class of temper observed in the Pinenut Site assemblage is notable for the presence of olivine, the iron-magnesium silicate associated with Moapa Ware. Olivine was noted in 309 sherds, 29% of the total, appearing either by itself or in a small number of cases, in combination with quartz sand, multilithic rock, or sherd. Olivine appears as a fine-to-medium-sized transparent crystal fragment either green or red in color (Weide 1978:181) and paling towards clear. It was often observed in small aggregates of crystals indicating it was probably ground to desired size. In 136 sherds olivine was the only tempering material observed. It ranges from fine particles spread evenly through the paste to medium-sized particles in large numbers but unevenly distributed through the paste. A total of 96 sherds exhibit a small number of olivine particles in combination with a fine light-gray, opaque angular particle assumed to be a crushed rock. Another 45 sherds exhibit olivine particles in combination with a quartz sand or sandstone temper. The remaining 26 sherds exhibiting olivine include 12 sherds also containing small particles of crushed sherd, 10 sherds exhibiting rounded particles of olivine in addition to rounded particles of white opaque rock with rounded clear quartz grains, and, finally, 4 sherds with occasional particles of olivine in combination with particles of dark-appearing angular quartz and small white opaque angular particles. The olivine and crushed sherd combination temper type has been noted among the collections from the Grand Canyon National Monument (Thompson 1971:45). The 10 sherds with the multilithic temper of rounded particles may represent the use of an unsorted arroyo sand containing olivine.

The remaining 27 sherds fall into three temper classifications each of which represents 1% or less of the total ceramic assemblage. A crushed sherd temper characterized by small white-to-gray, angular fragments with rare particles of rounded quartz sand account for 10 sherds. The final 17 sherds are unique in that they represent redware sherds rather than gray or whiteware sherds. A total of 14 of these sherds exhibit a fine rounded quartz sand in combination with very small multilithic fragments. The last 3 sherds are characterized by a temper composed of small fragments of crushed sherd with occasional grains of quartz sand. These final 3 sherds undoubtedly represent a Tsegi Orange Ware.

Paste Descriptions

Descriptions concerning paste include observations on color, temper type, vitrification, porosity, and strength. The latter three attributes are subjective in nature while color was observed in both the original state of the sherd and, in a small select sample, after refiring to a constant temperature in an oxidizing atmosphere. A wide variety of color was observed in the original sherd pastes followed by a rather narrow range after refiring. Post-firing color change substantiated the differentation between the Virgin Series sherds and those of the Shinarump Wares, both of which are largely tempered with quartz sand and sandstone. While a sample of Moapa Ware sherds was refired, this ware was initially separated on the basis of its unique olivine temper.

The largest number of sherds, 374 or 35% of the total, were described as having a light gray, light brownish-gray, or gray color paste. Very few of these lighter colored sherds appear vitrified although they usually appeared dense and well mixed, and broke sharply along right angles. Temper in the vast majority of these 311 sherds is the sand or crushed sandstone, with only 63 other sherds tempered with combinations of sand and angular or rounded light-colored, opaque rock or crushed sherd.

The second largest paste category includes 356 sherds, 34% of the total, and was differentiated on the basis of dark gray-to-black and brown colors. A large number of these sherds, particularly those with the dark gray and black-colored paste appear vitrified under the microscope. The sherds appear porous but are strong, breaking in clean fractures. As in the first category above, the majority of these sherds, 240, are tempered with the quartz sand or crushed sandstone temper. The remaining 116 sherds exhibit a mixed temper of sand or sandstone and a white to gray opaque crushed rock. The two temper types observed in this category cannot be differentiated with the naked eye and proved extremely difficult to separate with a 10-power hand lens. The dark gray and black sherds that are vitrified can often be identified macroscopically due to the combined visual effects of color, vitrification, and gross temper appearance.

After refiring, sherds from the first category above exhibit predominantly yellow and yellowish-red hues with a small number of reddish-yellow sherds. Post-refiring colors in the second category are entirely of reddish-yellow hues with the exception of one anomalous sherd which returned a hue of white.

The third major paste category, including 309 sherds or 29% of the total, was primarily identified on the basis of its olivine temper. The paste is typically light gray to gray in color although dark gray pastes were observed. Post-refiring paste colors range from pink to red including both yellowish-red and light red as well as a single specimen of strong brown. These clays do not appear vitrified and are dense though not as hard as those in the other categories, often breaking in a friable manner.

The fourth and final paste category includes the 17 redware sherds collected at the Pinenut Site. The paste of all of these sherds is similar with the exception of the tempers. Pastes are red to yellowish-red and appear well-mixed and dense. These sherds are not as hard as the majority of the gray sherds but do fracture along right angles. The paste invariably refires to red hues. Three of these sherds exhibit a tempering material of light-colored crushed sherd with occasional particles of quartz sand in addition to a pronounced gray core or carbon streak appearing in the center of the paste. The remaining 14 redware sherds exhibit a fine, rounded, quartz sand temper.

Typological Classification

Finding little difference in tempering materials, Wilson (1985:116-119) differentiated between Virgin Series sherds and Shinarump Wares on the basis of pre- and post-firing paste colors. He observed that the light-gray-to-gray pastes of the Virgin Series sherds exhibited postfiring hues of "buff, pink, yellow-red, and red colors." The sherds he identified as Shinarump Wares exhibited very dark brown or red pastes and refired to red or red-brown hues. Similar values were observed by Blinman (1986:87-89) for Shinarump sherds although his Virgin Series sherds refired to very pale brown and reddish-yellow.

While Wilson found no significant difference in the tempering material of his Virgin Series and Shinarump Ware sherds, it is notable that Blinman found 85.4% of his Shinarump Ware sherds exhibiting a mixed temper of sand and crushed light-colored rock (1986:86). This mixed temper type is similar to the second class of temper observed in the Pinenut Site assemblage. However, at the Pinenut Site, both the sand or crushed sandstone temper and the mixed sand and crushed opaque rock temper appear in each of the two major paste categories. In each case the sand or crushed sandstone temper type predominates over the mixed type.

Due to the similarity of tempering material found in the two major paste categories in the Pinenut Site assemblage, sherds were differentiated into Virgin Series and Shinarump Wares based on post-refiring paste color change. Following Wilson (1985), sherds from the first paste category with pre-refiring hues of light gray, light brownish-gray or gray that refired to yellow and yellowish-red were considered to be from Virgin Series ceramics. Sherds from the second paste category with dark gray-to-black and brown hues that refired to reddish-yellow hues were considered to be from Shinarump Ware ceramics.

Sherds from the third paste category exhibited a relatively wide post-refiring range of paste color hues but were considered to be Moapa Ware sherds on the basis of their olivine temper.

The redware sherds, representing the last and smallest paste category in the Pinenut Site assemblage, were also typologically differentiated on the basis of tempering material. Three sherds with the light-colored crushed sherd temper with occasional particles of quartz sand were typed as a Tsegi Orange Ware. The similarity of these sherds suggests that they all came from the same Tsegi Orange Ware bowl. The remaining 14 redware sherds exhibit a fine, rounded, quartz sand temper and can be identified as San Juan Red Ware: Little Colorado Series.

The Pinenut Site ceramic assemblage is presented typologically in Tables 7.1 through 7.4. Of the 1054 sherds recovered, most could be placed within the types of seven wares; the Tusayan Gray Ware and White Ware: Virgin Series, Shinarump Gray Ware and White Ware, Moapa Gray Ware, San Juan Red Ware and Tsegi Orange Ware. A small number of anomalous sherds from the assemblage are discussed hereinafter.

TABLE 7.1. Ceramic Materials from the Pinenut Site.

Tradition Type	Sherd Count (N)	 (%)
Virgin Series		
North Creek Gray	47	4.45
Plain Gray Body sherds	99	9.40
North Creek Corrugated	169	16.10
St. George B/g	3	0.30
B/w-Similar to North Creek Gray but with a slip	48	4.55
B/w Corrugated-Similar to Hurricane B/g but with a slip	7	0.70
Shinarump		
Shinarump Brown	28	2.65
Plain Gray Body sherds	141	13.40
Shinarump Corrugated	160	15.20
B/g-Similar to Virgin B/w but without a slip	5	0.50
Virgin B/w	19	1.80
Toquerville B/w	3	0.30
Moapa		
Boulder Gray	135	12.80
Plain Gray Body sherds	77	7.30
Moapa Corrugated	69	6.50
Moapa B/g	21	2.00
B/w Corrugated	5	0.50
Kayenta		
Tusayan B/r	1	0.10
Tsegi Orange Ware	2	0.20
San Juan Red Ware		
Little Colorado Series	14	1.30
TOTAL	1054	100.05%

TABLE 7.2. Virgin Series Ceramics.

N=373 (35% of Total Assemblage)	Design Style	Slip/Paint	Surface Finish	Subtotal
North Creek Gray (N=145)				
Plain Jar sherds				23
Jar sherds with smooth exterior				9
Plain bowl sherds				3
Bowl sherds with smooth interior				7
Bowl sherds with smooth interior and exterior				4
Plain body sherds of undetermined vessel shape				99
North Creek Corrugated (N=170)				
Jar body sherds				170
Jar sherds with fillet				6
St. George Black-on-gray (N=3)				
Bowl sherds with plain interior and exterior				3
Black-on-white; Similar to North Creek B/g but with slip (N=48)				
Bowl sherds				48
Sherds with smoothed interior and plain exterior			19	
Slipped on interior only		2		
Slipped on interior and exterior		17		
Sherds with organic paint pigment		17		
Sosi design style	10			
Undetermined design style	7			
Sherds w/combination organic & mineral paint pigment		1		
Undetermined design style	1			
Sherds with smoothed interior and smoothed exterior			29	
Slipped on interior only		5		
Slipped on interior and exterior		24		
Sherds with organic paint pigment		24		
Sosi design style	9			
Dogoszhi design style	2			
General PII design style	2			
Undetermined design style	11			
Sherds w/combination organic & mineral paint pigment		2		
Undetermined design style	2			
Black-on-white Corrugated; Similar to Hurricane B/g but with slip (N=7)				
Bowl sherds with smoothed interior and corrugated exterior				7
Slipped interior only		1		
Slipped on interior and exterior over corrugations		7		
Sherds with organic paint pigment		6		
Sosi design style	2			
General PII design style	1			
Undetermined design style	3			
Sherds with combination organic and mineral paint pigment		1		
Undetermined design style	1			

TABLE 7.3. Shinarump Series Ceramics.

N=354 (34% of Total Assemblage)

	Design Style	Slip/Paint	Surface Finish	Subtotal
Shinarump Brown (N=169)				
Plain jar sherds				17
Jar sherds with smooth exterior				2
Plain bowl sherds				3
Bowl sherds with smooth interior and exterior				4
Plain body sherds of undetermined vessel shape				143
Shinarump Corrugated (N=161)				
Jar body sherds				159
Jar sherds with fillet				2
Black-on-gray; Similar to Virgin Black-on-white but without slip (N=5)				
Bowl sherds with plain interior and exterior, all with organic paint			5	
Undetermined design style	5			
Virgin Black-on-white (N=19)				
Bowl sherds, all with smoothed interior, plain exterior				19
Slipped interior only		7		
Slipped interior and exterior		15		
Organic paint pigment		13		
Dogoszhi design style	4			
General PII design style	2			
Undetermined design style	7			
Mineral paint pigment		1		
Undetermined design style	1			
Toquerville Black-on-white (N=3)				
Bowl sherds, all with smoothed interior and corrugated exterior				3
Slipped on interior only		2		
Slipped on interior and exterior		1		
Organic paint pigment		3		
Sosi design style	3			

TABLE 7.4. Moapa Series Ceramics.

N=307 (29% of Total Assemblage)

	Design Style	Slip/Paint	Surface Finish	Subtotal
Boulder Gray (N=212)				
Plain jar sherds, 1 with fugitive red exterior				19
Jar sherds with smoothed exterior, 9 with fugitive red exteriors				57
Plain bowl sherds				6
Bowl sherds with smoothed interior only, 1 with fugitive red exterior				17
Bowl sherds with smoothed exterior and interior, 1 with fugitive red exterior				35
Gourd dipper fragment				1
Plain body sherds of undetermined vessel shape				77
Moapa Corrugated (N=69)				
Jar body sherds				69
Moapa Black-on-gray (N=18)				
Bowl sherds				18
Sherds with plain interior and exterior			2	
Slipped interior and exterior		2		
Organic paint pigment		2		
Undetermined design style	2			
Sherds with smoothed interior and plain exterior			6	
Slipped on interior only		9		
Organic paint pigment		2		
Sosi design style	1			
Undetermined design style	1			
Sherds with smoothed interior and exterior			10	
Slipped on interior only		2		
Slipped on both interior and exterior		8		
Organic paint pigment		5		
Sosi design style	3			
Dogoszhi design style	1			
Undetermined design style	1			
Corrugated Black-on-white (N=5)				
Bowl sherds				5
Sherds with smoothed interiors and corrugated exteriors			5	
Slipped on interior only		5		
Organic paint pigment		5		
Sosi design style	2			
Undetermined design style	3			

Eight sherds exhibit technological attributes of North Creek Gray (6) and Shinarump Brown (2) with the addition of fillets, a common Pueblo I jar characteristic elsewhere in the Anasazi Southwest. Following Blinman (1986:90), these filleted jar sherds were placed within the North Creek Corrugated or Shinarump Corrugated categories.

An unnamed black-on-white type in the Virgin Series is similar to North Creek Black-on-gray with the addition of a slip. Recognizable design styles exhibited by the unnamed black-on-white include Sosi and Dogoszhi elements as would be expected in North Creek Black-on-gray (Colton 1952:46). It could be argued that these sherds should be typed as Sosi and Dogoszhi Black-on-white and placed within the Kayenta Series rather than in the Virgin Series. They are not, simply because other contemporaneous, regional black-on-white types with slips exist, such as Shinarump White Ware, and also because of the scarcity of ceramics in the Pinenut Site assemblage which were imported from regions south of the Colorado River. Other investigators (Blinman 1986; Thompson 1971; Wilson 1985) note the nature of this beast. Blinman (1986:88) states that "it is likely that gray or whiteware sherds originating from the Kayenta Anasazi area, if present, have been arbitrarily included in this category," while Wilson solves the problem by utilizing a combination Virgin-Kayenta category (1985:119). In the same vein, 7 sherds of a corrugated black-on-white were noted in the Pinenut Site assemblage that are similar to Hurricane Black-on-gray but for the addition of a slip.

A like situation is found in the Shinarump Wares where 5 sherds of a black-on-gray type occur that could be classified as Virgin Black-on-white but for the lack of a slip. This phenomenon has been noted by others also (cf. Aikens 1965:99; Wilson 1985:118).

The final apparent anomaly noted in the regionally indigenous wares is in the Moapa Ware. A corrugated black-on-white with Sosi design style occurs which is similar to Toroweap Black-on-gray with the addition of a slip. Fortunately, Colton did note a variety of Toroweap Black-on-gray with a white slip (1952:81).

Undecorated plain grayware sherds were cached in the North Creek Gray, Shinarump Brown, and Boulder Gray categories. These include sherds with lightly smoothed surfaces that may conceivably have originated in a black-on-gray vessel. Sherds are morphologically described in each grayware category in Tables 7.2 through 7.4. Sherds from vessels whose form could not be discerned were placed in an "Indeterminate" category in the appropriate grayware.

A total of 12 sherds, all Boulder Gray, were recorded with fugitive red washes on their exteriors. Both jar and bowl sherds were observed with fugitive red washes.

A total of 17 redware bowl sherds were recovered which include 3 of Tsegi Orange Ware and 14 of San Juan Red Ware: Little Colorado Series. The latter account for the red paste category with fine quartz sand temper. None of these are decorated and specific types are unknown.

Tsegi Orange Ware sherds exhibit a red-colored paste with crushed sherd temper and dark gray carbon streak. One is decorated with a dark mineral paint and was identified as Tusayan Black-on-red. The remaining two Tsegi Orange Ware sherds are undecorated and were not placed in specific categories.

Vessel Form and Function

Five major vessel forms were noted in the Pinenut Site assemblage. These include plain jar sherds without corrugations or decoration, corrugated jar sherds, plain bowl sherds, decorated bowl sherds with painted designs, and a single gourd-shaped dipper fragment. Frequencies for these categories are noted in Table 7.5. No patterning in the distribution of sherds reflecting various vessel forms was noted within the various levels of the features.

The overwhelming majority of recognizable sherds, 74%, are jar sherds. While jars may be used for cooking purposes as well as bowls, this high frequency of jars to bowls points to a strong potential for storage capability. Notable also is the low number, 15%, of decorated sherds. There is a complete lack of decorated jar sherds. This paucity of decorated jars has been demonstrated in other regional assemblages (cf. Blinman 1986; Wilson 1985;) and appears characteristic of the indigenous population(s). In his original description of indigenous ceramics Colton (1952) noted only two decorated types having rare jar forms: North Creek Black-on-gray and Virgin Black-on-white. The single gourd dipper fragment was the only non-vessel ceramic found and is considered a utilitarian form.

TABLE 7.5. Vessel Form Frequencies for Gray Wares and White Wares.

N=717	Plain Jar Sherds	Corrugated Jar Sherds	Plain Bowl Sherds	Decorated Bowl Sherds	Gourd Dipper	Plain Body Shape Indeterminate Vessel Shape
Virgin Series	32	170	14	58		99
Shinarump Wares	19	161	7	27		143
Moapa Wares	76	69	58	25	1	77
	127 (18%)	400 (56%)	79 (11%)	110 (15%)	1 (1%)	319

Total jar sherds 527 (74%)
Total bowl sherds 189 (26%)

Percentages noted are for total of recognized vessel shape; indeterminate vessel shape totals not included.

Twelve sherds exhibit evidence of post-manufacture modification. All modifications involved grinding or abrading except one instance in which a vessel rim appears to have been chipped down, perhaps to even it after a chip was broken off. Of the ground modifications, 3 are sherds with single holes drilled through, apparently while the vessel was entire, and 7 are small sherds with single edges ground down, apparently after the vessel was broken. The drilled holes probably represent efforts to mend cracked vessels. No specific function is advanced for the sherds with ground edges, none of which appear to be complete.

The final modified sherd is a nearly complete spoon-shaped tool ground from a bowl sherd of Moapa Black-on-gray (Figure 7.1). The tool is presently nearly round and 5.3 cm in diameter with the proximal end, presumably a handle, broken off. There does not appear to be wear on the distal edges to indicate use. It was recovered from the floor of Room E in Feature 1.

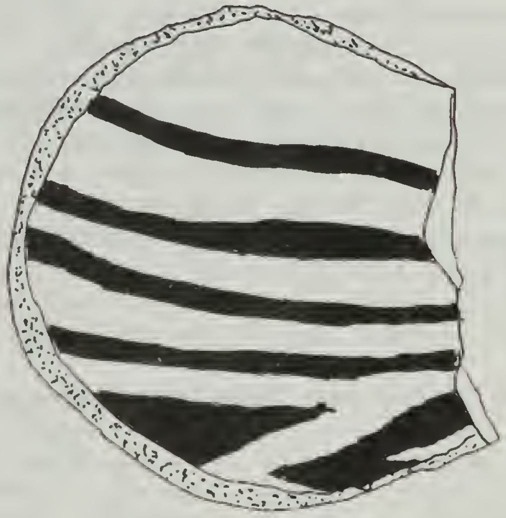


FIGURE 7.1. Moapa Black-on-gray sherd spoon.

Intersite Ceramic Relations

Provenience information for each ceramic category by stratigraphic excavation levels is given in Table 7.6. Notably, all three of the major ceramic categories, Virgin Series, Shinarump Wares, and Moapa Wares, are represented in all levels including floor levels. None of the categories predominates. Virgin Series ceramics account for 36% of the entire assemblage, Shinarump Wares 34%, and Moapa Wares 29%. Clearly, none of these frequencies represents a majority and hence, little information is present to suggest which the inhabitants of the Pinenut Site actually made, if any, and which are trade items. This lack of a predominant ware on a given site appears common in this area (Euler, personal communication 1987).

TABLE 7.6. Ceramic Materials from the Pinenut Site by Provenience.

		Trash Midden		Feature 1																						Feature 2									Feature 3				
VIRGIN SERIES	Surface Collection	Level 1	Level 2	Overall Level 1	Rm A Level 2	Rm A Level 3	Rm A Level 4	Rm A Level 5	Rm B Level 1	Rm B Level 2	Rm B Level 4	Rm C Level 2-3	Rm C Level 4-5	Rm D Level 1	Rm D Level 2	Rm D Level 3	Rm D Floor	Rm E Level 1	Rm E Level 2	Rm E Floor (in screen)	Rm E Hearth	Rm E Floor	Rm F Level 1	Rm F Level 2	Rm F Floor	Fea. 1 Fill	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Floor Fill	Floor	Level 1	Level 2	Level 3 3-B	Level 4 3-A	TOTAL
North Creek Gray	52	4	1	10	5	1	1			1	5	2	1	2	4	2		1	5	2					2		7	5	8	3	2	3	5	1	3	4			1	143
North Creek Corr.	59	3		9					5	3	22	2	1	12	3	1			8	5	1	6			1	3	6	3	4	1	4	3	1	2	1	1				170
St. George B/g	1										1															1														3
B/w	20	5		4		1						1			1	2			4	2		1					1	2		1						3				48
B/w Corr.				2	1	1									1																					2				7
SHINARUMP WARE																																								
Shinarump Brown	107	6		7	2	2		1	2		4			2	9		2		2	1					2	2	7	1	1		4	2	1		2					169
Shinarump Corr.	39		1	25		2			1		1	1		8	22	4	10	2	3	3		2	1		4	9	3	1	4	2	3	3	1	3	2					160
B/g	4																														1									5
Virgin B/w	10			2								1		1		1			1									1	1					1						19
Toquerville B/w				1																																2				3
MOAPA WARE																																								
Boulder Gray	100	4	1	25		2	1		1	1	5	3	2	10	11	5		3	3	6			1	1	1	1	8	5	1	2	3	1	1	2	1		1	3		215
Moapa Corr.	32	2		13	1	1			2			2	1	1	3			1	1						2	1	2				2				2					69
Moapa B/g	1			1	2								1			1			1	1		1			3	1	2					1			3	2				21
B/w Corr.	2			2												1																								5
Tusayan B/r																											1													1
Tsegi O.W.	2																																							2
San Juan R.W.	3			1							1	1		3	1	2				1							1													14
TOTAL	432	24	3	102	11	10	2	1	11	5	39	13	6	39	55	19	12	7	28	21	1	10	2	1	15	18	38	18	19	9	19	13	9	9	14	14	1	3	1	1054

In some respects, the Moapa Wares may be considered trade items since the nearest source of the olivine tempering material is the Mt. Trumbull area approximately 23 miles southwest of the Pinenut Site. In other respects, however, this is not a great distance for a foraging party to travel if the Pinenut Site inhabitants experienced unpredictable resource availability leading to foraging over larger distances (Powell 1983). One would only need to bring home a single lump of olivine to temper many vessels.

While the production of the Moapa Wares requires a unique tempering material, olivine, both the Virgin Series ceramics and the Shinarump Wares have similar temper characteristics to a large extent. However, it is not considered likely that these two categories, or the Moapa Wares, were all made at the Pinenut Site. The argument that all three categories of ceramics could have been made at the site falls apart in light of the ceramic paste refiring analysis. The differing hues obtained for the three separate categories argue for separate clay quarrying locations. It may not be reasonable to expect a potter from the Pinenut Site to travel to three different locations to gather construction materials. For this reason it is assumed that all three ceramic categories were not made at the Pinenut Site. Moreover, a pottery manufacturing technology does not appear to be respresented at the site. Such would be indicated by lumps of unfired clay, pottery sherd scrapers, tempering raw material, and the like. These items were not recovered from the Pinenut Site.

No other ceramic analyses from sites in the immediate area have been conducted with which to compare the Pinenut Site assemblage. Hence, a comparison between different site assemblages would not give information regarding whether the Virgin Series ceramics or the Shinarump Ware ceramics are the indigenous wares. The answer to this question will probably need to await either local clay resource analysis studies or further excavation in the area resulting in comparative collections which can be analyzed via a rigorous attribute analysis including paste refiring analysis. The Moapa Ware ceramics, however, are considered to have been trade items at the Pinenut Site. Trade to the south of the Colorado River is indicated by the Tsegi Orange Ware sherds. The Little Colorado Series redware probably also indicates contact with other groups in the southwest Utah region.

Ceramic Dating Considerations

Reliable site dating was relatively unknown for sites on the Arizona Strip; hence, Colton's estimated dates for the Virgin Series ceramics were based on cross-referencing ceramic design styles in the Kayenta Series, with which he was most familiar. To some extent, Colton's dates are no longer considered reliable (cf. Thompson 1986:355) though the culturally descriptive terminology (Pueblo I, Pueblo II, etc.) can still be used.

The majority of the ceramic types observed at the Pinenut Site were originally noted by Colton (1952) to represent middle to late Pueblo II times. In the Virgin Series both North Creek Gray and North Creek Corrugated were considered Pueblo II to Pueblo III types. North Creek Black-on-gray and Hurricane Black-on-gray were considered middle Pueblo II and late Pueblo II types, respectively. St. George Black-on-gray, represented at the Pinenut Site by only three sherds, was considered by Colton to be an early Pueblo II type while Washington Black-on-gray, his Pueblo I type, does not occur in the Pinenut Site assemblage.

Shinarump Brown and Shinarump Corrugated, the utility types of the Shinarump Wares, were thought by Colton (1952) to be Pueblo III wares. He placed the associated decorated Virgin Black-on-white and Toquerville Black-on-white types into the late Pueblo II to early Pueblo III and Pueblo III times respectively. For the Moapa Wares, Colton referred to Boulder Gray as Basketmaker III to Pueblo I in conjunction with Boulder Black-on-gray while Moapa Corrugated and Moapa Black-on-gray were the Pueblo II to Pueblo III types. Trumbull Black-on-gray, an early Pueblo II type, and Toroweap Black-on-gray, another Pueblo II type, did not occur at the Pinenut Site.

At the Pinenut Site both Shinarump Brown and Shinarump Corrugated, Colton's Pueblo III types, and Boulder Gray, his Basketmaker III to Pueblo I type, occur side by side in several levels including the floor level in Room F of Feature 1. At the same time these three types share most of the excavation levels with the predominant Pueblo II types. Hence, Colton's dating scheme does not appear to be supported by the Pinenut Site ceramic assemblage.

Thompson (1986:355) has suggested a dating scheme based on more recent data including regional radiocarbon dates. Although Thompson does not deal with the Shinarump Wares, he does present a time span of from Basketmaker III to Pueblo III for Boulder Gray. It appears plausible that Colton's dating for Shinarump Brown and Shinarump Corrugated should also be revised to reflect earlier times and, presumably, longer time periods.

As noted above, Colton's (1952) Pueblo I and early Pueblo II decorated types, Boulder Black-on-gray, Washington Black-on-gray, and Trumbull Black-on-gray, do not occur in the Pinenut Site assemblage. The Pueblo II types that do occur exhibit design styles recognizable in terms of the Late Pueblo II types south of the Colorado River: Sosi Black-on-white and Dogoszhi Black-on-white with overall frequencies of 30 sherds and 7 sherds respectively. Sosi and Dogoszhi styles began a period of popularity in the Kayenta area about A.D. 1075 and 1085, respectively (Breternitz 1966). Wilson reports a sherd of Virgin-Kayenta type with a Dogoszhi design style from one of the Vermilion Cliff sites, 42Ka2585, with two radiocarbon dates of A.D. 990 and A.D. 1110 (1985:123).

Two indeterminate categories denoted sherds with too little design present that could have been either a Sosi or Dogoszhi motif (n=45), and a general Pueblo II category which included small sherds with sections of checkerboards, dots, or non-Sosi linear designs (n=5).

The redware sherds observed in the Pinenut Site assemblage also argue for a Pueblo II assignation. The Tusayan Black-on-red is dated as a trade item between A.D. 1050 and about 1200 (Breternitz 1966), while the San Juan Red Wares: Little Colorado Series are thought to have been manufactured in southwestern Utah between A.D. 1050 and 1150 (Geib et al. 1986:21).

A total of eight radiocarbon dates were obtained for the Pinenut Site (see Chapter VI). These appear to cluster into two groups. The first of these overlap during the A.D. 1020 to 1060 time period. However, this appears skewed by the A.D. 980 date for Feature 1, Room E. If this date is rejected as aberrant, the other two dates of this cluster match closely near A.D. 1100 with standard deviations overlapping from A.D. 1020 to 1140.

The second cluster of five dates are later with four of their mean dates occurring from A.D. 1235 to 1290 and standard deviations overlapping from A.D. 1230 to near A.D. 1300. The fifth radiocarbon date of this cluster, for Feature 1, Room D, has a mean date of A.D. 1360 which is outside of the overlap of the previous four standard deviations. The standard deviation for this fifth date does, however, overlap that of the others during the period from A.D. 1275 to near A.D. 1300.

The early date obtained from Feature 1, Room E, may be aberrant. To begin with, neither St. George Black-on-gray nor Trumbull Black-on-gray, placed in the A.D. 900-to-1100 range by Thompson (1986:355), appears in the fill of Room E. Only 3 sherds of St. George Black-on-gray were recovered from the entire Pinenut Site while Trumbull Black-on-gray does not occur at all. Secondly, the only decorated sherds recovered from the floor of Room E were 2 sherds of Moapa Black-on-gray and 3 sherds of a black-on-white and exhibiting a slip. Neither of these types gains prominence until around A.D. 1100 (Thompson 1986:355).

The remaining two dates from the earlier cluster are from Feature 1, Room B and Feature 2 with mean dates of A.D. 1080 and 1090, respectively, and standard deviation ranges that overlap from A.D. 1020 to 1140. At the early end of this overlap one would expect to find St. George Black-on-gray and Trumbull Black-on-gray sherds as mentioned above. As this is not the case at the Pinenut Site, it appears safe to infer that the earliest occupation of the site may not have been until around A.D. 1100.

The second cluster of dates has four mean dates in the period A.D. 1235 to 1290. The fifth date in this later cluster, A.D. 1360 with standard deviations of A.D. 1275 to 1445, from Feature 1, Room D, appears rather late in terms of the ceramic types observed. Decorated ceramic types recovered from the fill of Room D include 3 sherds of a black-on-white type similar to North Creek Black-on-gray, 1 sherd of a corrugated black-on-white type similar to Hurricane Black-on-gray, 2 sherds of Virgin Black-on-white, and 6 sherds of San Juan Red Ware: Little Colorado Series. Although no dating information is known for

Virgin Black-on-white and Hurricane Black-on-gray, North Creek Black-on-gray probably begins to disappear with North Creek Gray around A.D. 1225 (Thompson 1986:355). Thompson also notes that North Creek Gray decreases significantly after A.D. 1250 although it is present in the fill of Room D at the Pinenut Site (1986:355). Additionally, production of the Little Colorado Series of San Juan Red Ware is thought to have ceased by A.D. 1150 (Geib et al. 1986:21).

For these reasons it appears that the radiocarbon date for Feature 1, Room D, is possibly aberrant as is that of the earliest date in the first cluster of dates. Without the late date from Feature 1, Room D, the standard deviations of the remaining dates in this cluster appear to overlap with the ceramic dating advanced by Thompson (1986:355), although on the earlier end of the standard deviations. Based on these dates it appears plausible to place the occupation of the Pinenut Site as late as A.D. 1275. If such is the case it may be possible to extend the date of Moapa Black-on-gray beyond A.D. 1225 (cf. Thompson 1986:355).

Based on the two clusters of radiocarbon dates obtained for the Pinenut Site, it is possible to postulate two occupations for the site: a short-lived one around A.D. 1100 and a longer occupation in the neighborhood of A.D. 1200 to 1275. However, as there is no significant difference in the ceramics from the two time periods at the site, it is also possible that a change in subsistence strategy by the same group is being documented. The earlier cluster of dates may indicate short-term seasonal occupation based on subsistence mix while the later apparently more long-term cluster of dates may indicate a change to a more sustained re-occupation of the site.

One piece of evidence pertaining to dating the Pinenut Site ceramic assemblage is the radiocarbon dates of A.D. 1040 and 1100 obtained for the Kanab Site near Kanab, Utah (Nickens and Kvamme 1981:68-69). The ceramic assemblage of the Kanab Site was dominated by North Creek Gray followed by St. George Black-on-gray and Shinarump Gray. St. George Black-on-gray is Colton's (1952) early Pueblo II decorated ware in the Virgin Series. This site is also notable for having only one sherd of Shinarump Corrugated. In relation to the Pinenut Site, it appears to be slightly earlier, giving perhaps the earlier parameter for the re-occupation of the Pinenut Site.

One element of negative data should be noted. There are no decorated vessels with Pueblo III design styles on the site, such as the Tsegi Orange Ware polychromes. These are considered sensitive time indicators (Geib et al. 1986:20) which should begin to occur in the region by A.D. 1200. The general paucity of trade wares from south of the Colorado River at the Pinenut Site may simply indicate that the site inhabitants did not participate in Pueblo III ceramic exchange.

Conclusions

The analysis of the Pinenut Site ceramic assemblage indicates that five ceramic traditions are represented. Sherds of the Virgin Series, Shinarump Wares and Moapa Wares dominate the assemblage although none of these categories in itself can be conclusively demonstrated as being the indigenous ceramic category at this site if, indeed, any are. Also present in small numbers are Tsegi Orange Ware sherds and San Juan Red Ware: Little Colorado Series sherds. The latter two categories as well as the Moapa Wares are probably trade wares on the site.

Occupation of the Pinenut Site may have occurred at two specific times during the mid to late Pueblo II period around A.D. 1100 and again from around A.D. 1200 to 1275. However, the occupation may have also been continuous with a change in subsistence strategies. The earlier date could indicate seasonal use of the site with the later dates indicating a change to a more sustained habitation function by the same cultural or family group.

Site function can only be weakly inferred from ceramic vessel morphology. Although the large number of jar-shaped vessels points to a large storage capability, the general size of the site may indicate a habitation rather than a field house situation. The two are not mutually exclusive, however. Presumably a permanent habitation in this region would include a large storage capability.

From the viewpoint of the ceramics observed, the inhabitants of the Pinenut Site do not appear to have been exposed to a large amount of trade with adjacent Anasazi regions. Few exotic ceramic types were observed, all from the Kayenta Anasazi area south of the Colorado River. The small quantity of trade goods may reflect either the isolation of the area or the short time span of the occupations.

The ceramic technologies of the Pueblo II Virgin Series, Shinarump Wares and Moapa Wares have been observed and recorded. Virgin Series and Shinarump Ware sherds were separated on the basis of clay paste characteristics, primarily color changes noted after refiring the sherds to standard temperatures and oxidizing atmosphere. This method is recommended to future researchers in the region.

CHAPTER VIII

ANALYSIS OF LITHIC ARTIFACTS FROM THE PINENUT SITE

by

William E. Davis

Introduction

Excavation of the Pinenut Site recovered 1565 lithic artifacts which can be broken down into three main categories: chipped stone tools, debitage, and ground/battered stone tools. In part, this assemblage constitutes four gross functional categories consisting of grinding, cutting/scraping, piercing, and pounding/crushing tools. Other artifacts not relating to these or other specific functional uses were classified as waste or debitage. Overall, debitage from the production and maintenance of stone tools comprises the majority of the lithic artifacts (76%). The remaining 24% consist of complete and fragmentary stone tools.

As stated in Chapter III, the lithic analysis format was designed to meet the needs of the project research design. Accordingly, the major goals of the lithic analysis were to identify tool kits associated with either a horticulturally-based subsistence strategy or a mixed subsistence strategy. In essence, it is believed that the quantity and diversity of lithic artifact types and their related technological attributes will be directly related to site function. In order to address these goals, analytical methods were designed to provide inferences about three behavioral realms: lithic function, technological/production techniques, and raw material selection.

The analysis of lithic tools was approached with full realization of the complexities and often arcane nature of use-wear analysis. The collection was studied using a techno-morphological classification and a rather generalized attribute analysis of edge damage patterns. Examination of edge damage employed a "low power" approach which focuses primarily on microflaking and abrasion on the edges of tools (Tringham et al. 1974; Odell 1979, 1981; Odell and Odell-Vereecken 1980). The edges of specimens were routinely checked with a hand lens and, when necessary, use-wear was verified using a binocular microscope capable of magnification as high as 40x.

The analysis of production techniques is pertinent to typology, for detailed analysis of the various stages of the manufacturing process can give clues to technique and functional need (Crabtree 1972:3). Technological and morphological descriptions of lithic specimens followed relatively standard procedures and terminology (Holmes 1919; Crabtree 1972; Tixier 1974). Classification of artifacts into distinct typologies was based on shared morphological and utilization attributes. In cases where too few artifacts were found to justify a typology, individual artifacts were separately described.

The prehistoric selection of raw materials for chipped stone tools constitutes the third behavioral realm. The identification of geologic source localities is extremely useful for interpreting material procurement strategies and providing insights into exchange strategies and relationships. It was expected, however that little raw material variability would occur in the Pinenut Site lithic assemblage due to the vast chert deposits locally available throughout the Arizona Strip. In particular, the Permian Kaibab Formation provides an extensive supply of poor to good quality knapping material for making stone tools (Brown 1982). The texture of chert found in outcrops of Kaibab Limestone varies from a brittle, calcareous medium-textured rock to a fine-grained gritty, vitreous quality. In the immediate region of the site, numerous outcrops of Kaibab chert occur along the canyon rim and walls of Water Canyon, including a high-grade white chert with good conchoidal fracturing properties (Tom Rasmussen, Energy Fuels Nuclear, Inc., personal communication 1987). The cherts found in these outcrops commonly occur in either a tabular or more blocky amorphous shape.

Another raw material type present in the general region, but not locally found in the Pinenut project area is a variety of fine jaspers, quartzites, silicified woods, cherts and chalcedonies derived from the Shinarump Member of the Chinle Formation. The nearest in situ exposure of the Chinle Formation is at the base of the Shinarump Cliffs near Fredonia, Arizona, approximately 50 kilometers northeast of the Pinenut Site (Tom Rasmussen, personal communication 1987). Redeposited Chinle materials also occur as lag gravels throughout much of the Arizona Strip (Brown 1982:7).

Selected material types for ground stone implements consist mainly of sandstone. Sandstones are available in exposures of the Harrisburg Member of the Kaibab Limestone Formation in the immediate vicinity of the Pinenut Site. These range in texture and hardness from a fine-grained hard pink to a laminated soft tan sandy siltstone. In addition, some specimens were cobbles of a coarse-grained, very hard, purplish sandstone derived from the Shinarump Member of the Chinle Formation.

The following section defines and discusses the different types of stone tools and debitage recovered from the Pinenut Site. All measurements are given in millimeters. Unless otherwise noted, the raw material of all specimens described hereinafter is Kaibab chert.

Projectile Points

The term projectile point refers to relatively small, thin, bifacially-flaked tools which exhibit a point at the distal end (except where broken or reworked) and special modification of the proximal end to produce a haft (cf. Davis, in press). A total of 30 projectile points were recovered from the Pinenut Site, of which 15 are taxonomically diagnostic. The collection represents a rather limited array of notching and hafting styles with the majority reflecting a relative chronology that correlates with the radiocarbon dates retrieved from the site (see Chapter 6, this volume). The projectile point taxonomy that follows is consistent with the techno-facies and the techno-complexes that have been developed for the Great Basin and northern Colorado Plateau. Projectile point types are described by stylistic, morphological, and metric attributes.

Small Basal-notched Points

Eight small triangular projectile points exhibiting basal notches were placed in this group. Each point shows basal variation to some extent; all were notched rather than truly stemmed according to Holmer's (1986:94) criteria. Four specimens (Figure 8.1A, B, C, D) have moderately deep notching at the base near the corner, forming short square to slightly rounded stems. The basal notching on three other specimens is broad and shallow, forming a rounded to slightly pointed short stem or projection (Figure 8.1E, F, G). The notching on the eighth point resulted in a semi-round, convex base (Figure 8.1H).

Cross-sections are generally quite thick and range from biconvex to twisted lenticular. Blade outlines are straight to concave. Most of the points appear to be manufactured from thick flake blanks, flaked by irregular bifacial percussion thinning with only minimal pressure retouch. In several cases extensive percussion flaking along lateral margins created a very steep edge angle extending up to the medial ridge. Artifact 852, very well-made and finely pressure-flaked, is the one exception (Figure 8.1H).

Three specimens exhibit light use-wear typical of that found on knives and other cutting implements, while tip blunting and smoothing on two specimens suggest secondary utilization as drills. In most examples, observed step-flaked and crushed lateral edge margins probably resulted from manufacturing damage or edge rejuvenation.

Morphologically and stylistically, these small basal-notched points do not fit well into any defined type, as recently pointed out by Dalley and McFadden in their analysis of projectile points from the Virgin Anasazi Red Cliffs Site (1985:111). Nevertheless, four specimens (Figure 8.1A, B, C, D) are similar to what other researchers in the region have classified as Eastgate (Fowler et al. 1973:27; Lanning 1963:253; Walling et al. 1986:394; Westfall et al. in press:107). The remainder display attributes comparable to Parowan Basal-notched (Figure 8.1E, F, G) (Davis 1985:142; Moffit et al. 1978:111; Thompson 1986:395). Examples from the Pinenut Site are not, however, the type specimens (compare with Heizer and Baumhoff 1961:123, 128; Holmer and Weder 1980:60; Marwitt 1970:78). The temporal framework for Parowan and Eastgate points roughly spans the period A.D. 800 to 1300 (Janetski and Holmer 1982; Jennings 1978; Marwitt 1970).

Average Measurements:	Length:	Range:	32-16 mm
		Mean:	23.6mm
		Standard Deviation:	4.4

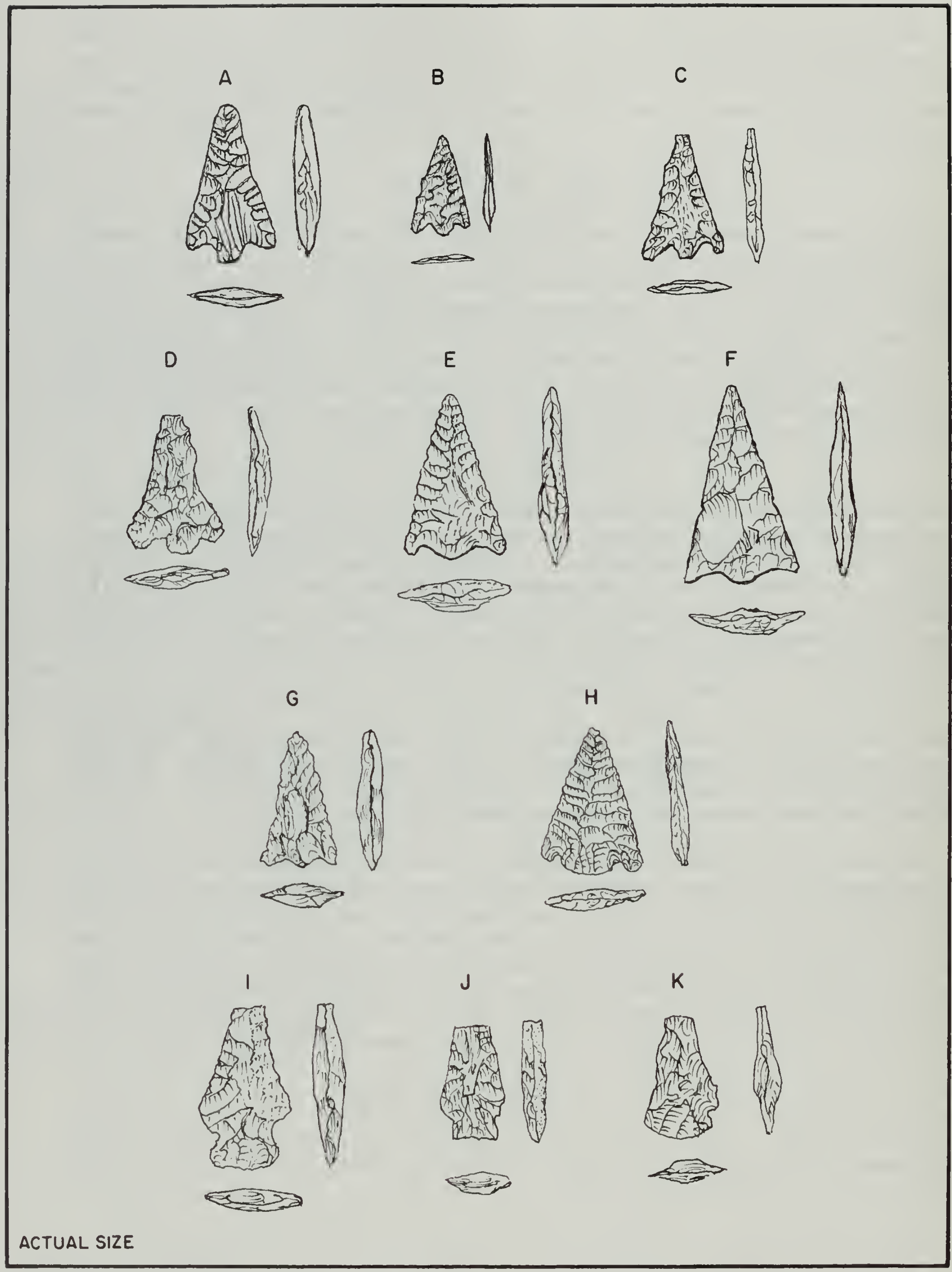


FIGURE 8.1. Small Basal-notched Points: A, B, C, D, E, F, G, H; Small Corner-notched Points: I, J, K.

Width: Range: 18-10 mm
Mean: 14.6 mm
Standard Deviation: 2.5

Thickness: Range: 6-2 mm
Mean: 4.1 mm
Standard Deviation: 1.2

Small Corner-notched Points

Two small elongated-to-triangular points with relatively deep corner notches (Figure 8.1I, J) and one point which was notched on only one corner (Figure 8.1K) were placed in this category. The former two specimens exhibit expanding-to-straight stems with straight bases and straight to slightly concave blade margins. The latter point exhibits a bifacially-beveled convex base.

The three points display thick biconvex to lenticular transverse cross-sections and coarse bifacial flaking with retouch terminating along the longitudinal ridges. These points are stylistically not strictly diagnostic but quite similar to Rose Springs Corner-notched (Jennings 1978:49; Moffit et al. 1978:111; Walling et al. 1986:394).

Average Measurements: Length: Indeterminate

Width: Range: 14-20 mm
Mean: 12.0 mm
Standard Deviation: 1.6

Thickness: Range: 6-4 mm
Mean: 5.0 mm
Standard Deviation: 0.8

Large Miscellaneous Points

Artifact 865

This reworked formerly lanceolate point exhibits extremely low and shallow corner-notching which created a broad straight base (Figure 8.2A). The upper lateral edge margins display heavy bifacial pressure retouch converging to a small pointed tip. Both the tip and upper convex blade margins exhibit wear characteristic of a drill. The cross-section is relatively thin and biconvex. The haft element is stylistically indeterminate.

Measurements: Length: 34 mm
Width: 23 mm
Thickness: 5 mm

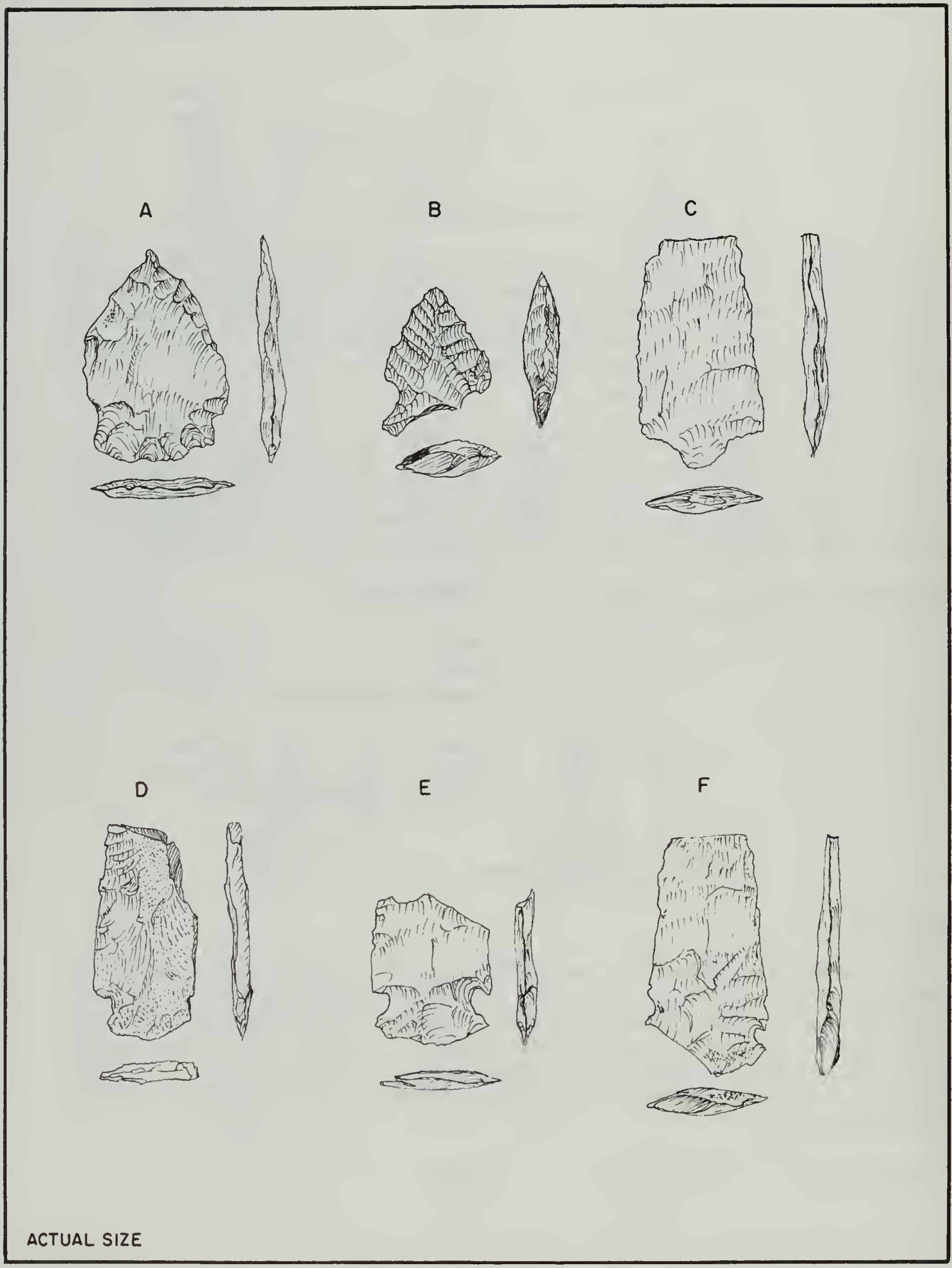


FIGURE 8.2. Large Miscellaneous Points.

Artifact 333

Artifact 333 is a short broad triangular dart point with an expanding stem and bifurcated base (Figure 8.2B). The expanding stem, formed by high corner notching and a deep basal concavity, gives the specimen a distinctive flared-ear appearance. The point is biconvex in cross-section and exhibits fine-patterned pressure retouch. Stylistically, the point is within the range of the Elko Eared type (Fowler et al. 1973:21; Jennings 1978:64; Moffit et al. 1978:109). The point is made of white translucent chalcedony.

Measurements:
Length: 24 mm
Width: 17 mm
Thickness: 6 mm

Artifact 241

This specimen is a classic Archaic Gypsum point which has been recycled into a hand-held knife (Figure 8.2C). Minor secondary resharpening and subsequent edge-use along the lateral margins have partially obscured the sides of the old transverse tip fracture. The point still exhibits its original basal morphology consisting of a contracting stem and a rounded base. Cross-section is biconvex.

Measurements:
Length: Indeterminate
Width: 19 mm
Thickness: 5 mm

Artifact 866

Artifact 866 is a large lanceolate corner-notched projectile point that snapped near the tip and burinated longitudinally to the base (Figure 8.2D). The left blade margin is straight, the shoulder rounded, and the base straight to convex. No evident use-wear was observed. It is stylistically similar to the Elko Corner-notched type (Fowler et al. 1973:21; Holmer 1978:35; Thomas 1981:20-22).

Measurements:
Length: Indeterminate
Width: Indeterminate
Thickness: 4 mm

Artifact 864

Based on Heizer and Baumhoff's 1961 type description, this midsection/basal fragment more closely represents the Elko Series Corner-notched variety than the point fragment previously described. Artifact 864 exhibits tanged shoulders, fairly wide horizontal-to-oblique notching, an expanding stem, and a convex base (Figure 8.2E). The artifact displays a relatively thin biconvex cross-section and was made by soft-hammer percussion thinning of a flake blank with final marginal pressure flaking retouch. The point fragment displays a jagged midsection hinge snap which shows slight edge-wear on the projections. Edge damage consists of unifacial microscarring and some polish indicating a probable scraping usage. It is unknown if the broken specimen was used while still hafted or was later recycled for casual use.

Measurements:	Length:	Indeterminate
	Width:	29 mm
	Thickness:	4 mm

Artifact 863

The last large miscellaneous point is a lanceolate fragment snapped near the tip and missing part of the base (Figure 8.2F). The specimen displays small narrow side-notching and a broad, very convex base. The point is biconvex in cross-section with slight evidence of a medial ridge. Stylistically, the point is indeterminate.

Measurements:	Length:	Indeterminate
	Width:	19 mm
	Thickness:	5 mm

Indeterminate Point Fragments

This group consists of projectile point fragments too indeterminate in both morphological and stylistic attributes to place into one of the aforementioned groups. The fragments include 6 point tips, 6 midsections, and 1 basal fragment. The tip fragments exhibit either snap or hinge fractures, and lack of impact flake scars tentatively implies these points did not function as a projectile at the time of fracture. The midsection fragments characteristically exhibit tip and haft snaps. None of the point fragments display any subsequent wear or resharpening.

Average Measurements:	Length:	Indeterminate	
	Width:	Range:	20-12 mm
		Mean:	16.2 mm
		Standard Deviation:	2.7
	Thickness:	Range:	5-1 mm
		Mean:	3.2 mm
		Standard Deviation:	1.2

Bifaces

The term biface is used here to refer to all specimens flaked on both the obverse and reverse faces. Excluded from consideration are all relatively small, thin, bifacially-flaked items which possess a sharp point on one end and a haft element on the opposite end. These artifacts have been described separately as projectile points.

Forty-five bifaces were recovered from the Pinenut Site. The relatively large size of the collection and its morphological diversity allowed for the formation of two basic biface types. The first type (Type I) is comprised of bifacially-flaked, bilaterally-utilized implements that were either hafted or unhafted (hand-held). The hafted bifaces or knives, were identified on the basis of blade conformation and hafting element, while the unhafted bifaces were subdivided on the basis of general outline and blade conformation. The second biface type (Type II) consists of production rejects or bifaces evidently broken of discarded prior to completion of manufacture.

Type I Small Unhafted Pinnate Bifaces

This subgroup includes 6 complete and 5 basal/midsection fragments characterized by biconvex cross-sections and an outline that is pinnate or teardrop-shaped with a straight-to-slightly convex base and a pointed tip (Figure 8.3). The lateral edges usually display one straight edge and the other concave. As exemplified by their longitudinal curvature, six of the bifaces were bifacially manufactured from thin flake blanks with several still retaining remnants of their platforms (Figure 8.3A, C, D, E, J, K). All specimens exhibit irregular patterns of bifacial thinning with pressure flaking utilized as a means of edge development. Most of these artifacts could be classified as unnotched projectile point preforms. However, observable tool edge-wear and resharpening on several of the examples implies that they were probably used as light hand-held cutting implements.

Average Measurements:	Length:	Range:	41-26 mm
		Mean:	33.4 mm
		Standard Deviation:	5.2
	Width:	Range:	20-11 mm
		Mean:	15.9 mm
		Standard Deviation:	2.6
	Thickness:	Range:	5-3 mm
		Mean:	4.2 mm
		Standard Deviation:	0.6

Type I Large Unhafted Pinnate Bifaces

One complete, one tip, and two basal fragments constitute this small subgroup (Figure 8.4A, B). Although represented by only four specimens, this subgroup displays morphological attributes similar to the aformentioned subgroup with the exception that they are considerably larger. Comparison of mean measurements indicate that these bifaces are approximately 12 mm longer, 14 mm wider, and 2 mm thicker. Flaking charactertistics also differ with all four specimens exhibiting irregular percussion thinning with no evident pressure retouch on the margins.

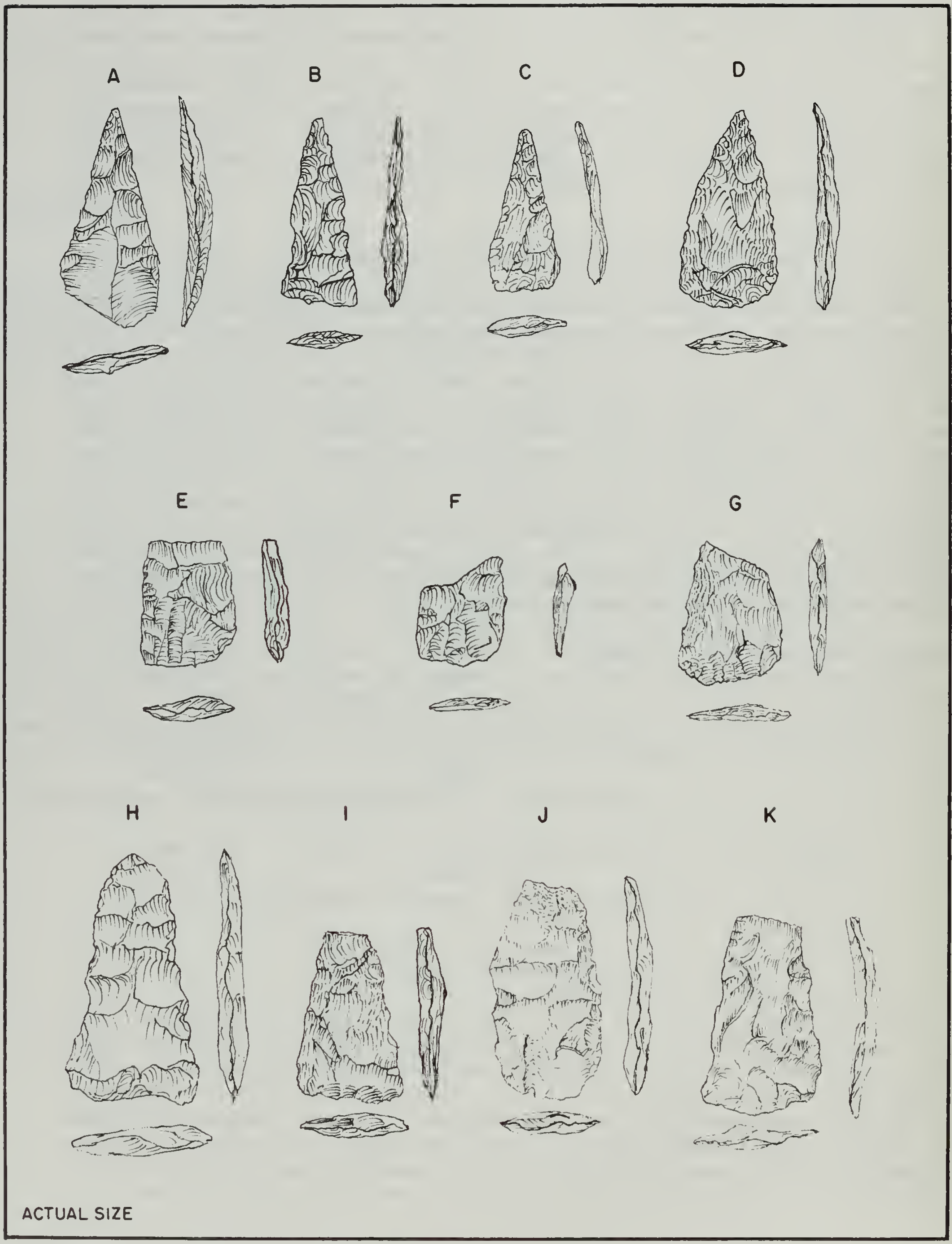


FIGURE 8.3. Type I Small Unhafted Pinnate Bifaces.

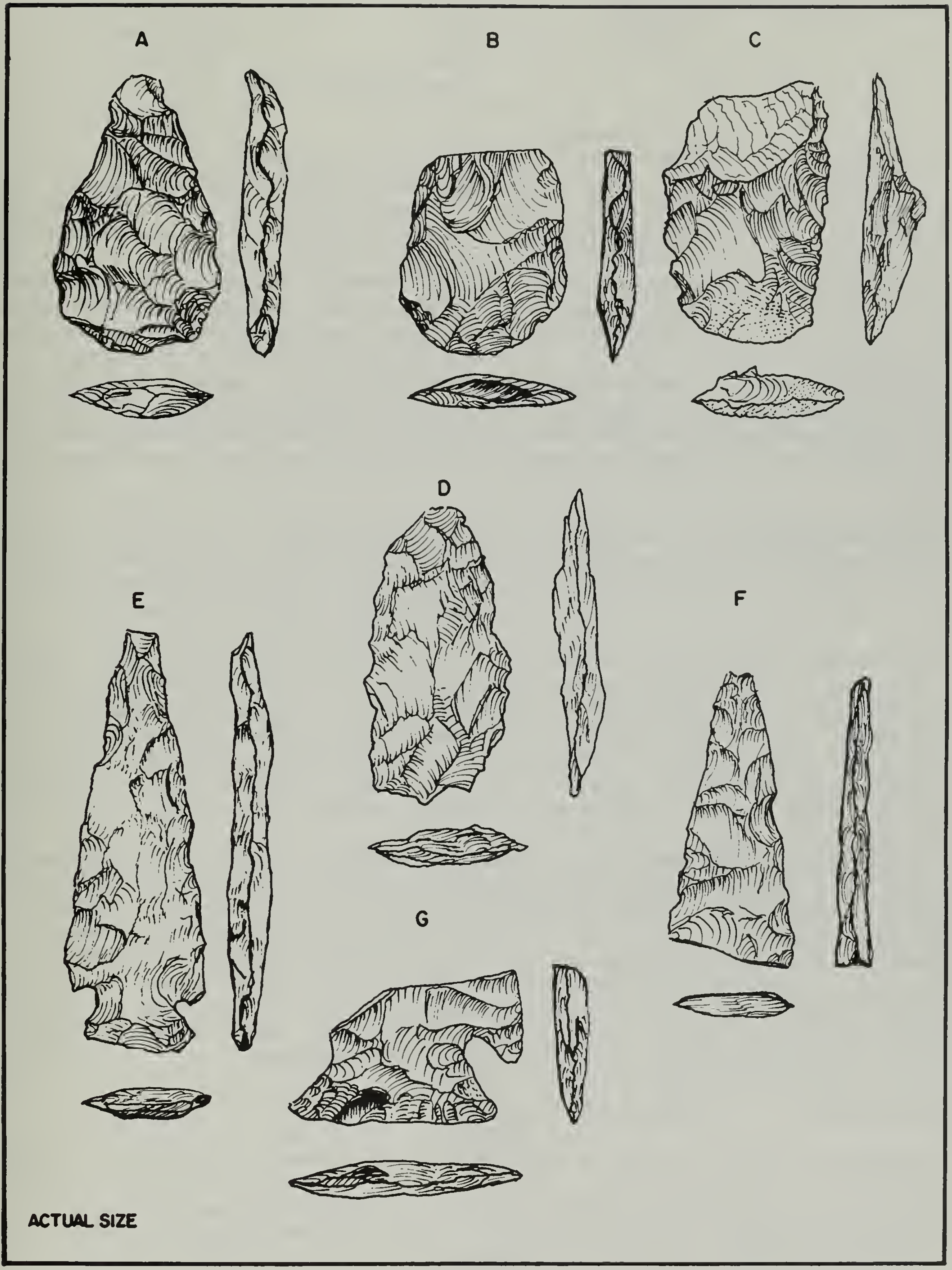


FIGURE 8.4. Type I Large Unhafted Pinnate Bifaces: A, B; Type I Large Lanceolate Bifaces: C, D; Type I Large Corner-notched Bifaces: E, F, G.

Average Measurements: Length: Artifact 471: 45 mm

Width: Range: 36-27 mm
Mean: 30.0 mm
Standard Deviation: 4.2

Thickness: Range: 8-5 mm
Mean: 6.2 mm
Standard Deviation: 1.1

Type I Large Lanceolate Bifaces

These four specimens exhibit regular bifacial flaking of a thick flake blank and limited pressure retouch in edge development (Figure 8.4C, D). Blade outlines are straight-to-convex, shoulders square-cornered-to-slightly convex, and basal sections display a straight-to-slightly convex basal edge. The two basal and midsection fragments exhibit medial and hinge snaps. Edge-wear consists of light grinding and crushing with step fractures. Artifact 869 displays a high polish on both basal faces and gross basal edge grinding indicating probable hafting (Figure 8.4D).

Average Measurements: Length: Artifact 356: 47 mm

Width: Range: 31-22 mm
Mean: 25.2 mm
Standard Deviation: 3.7

Thickness: Range: 10-4 mm
Mean: 6.5 mm
Standard Deviation: 2.3

Type I Large Corner-notched Bifaces

One complete (Figure 8.4E) and two fragmentary specimens (Figure 8.F, G) were classified as hafted bifaces or knives. Two exhibit hafting elements consisting of relatively deep oblique corner notches, tanged shoulders, expanding stems, and irregular-to-straight bases. The basal segment of Artifact 884 (Figure8.4G) is missing but its general outline and blade conformation is very similar to Artifact 883 (Figure 8.4E), giving credence to its placement in this subgroup. The wear on the lateral edges of these tools varies; attrition, edge crushing, and blunting suggest heavy duty cutting and extensive re-use.

Measurements: Artifact 883: Length: 70 mm
Width: 21 mm
Thickness: 7 mm

Artifact 887 Length: Indeterminate
Width: Indeterminate
Thickness: 6 mm

Artifact 884	Length:	Indeterminate
	Width:	20 mm
	Thickness:	6 mm

Type II Bifaces

As previously mentioned, Type II bifaces consist of production rejects or bifaces evidently broken or discarded prior to completion. Three complete and twenty fragments constitute this type. These specimens exhibit considerable variation in morphology which indicates that some specimens were much further along in the manufacturing process than others. In order to identify and classify the bifaces according to manufacturing stages, a very useful but rather idealized model was adopted and slightly modified from Callahan (1974, 1979).

Callahan (1974, 1979:36-37) identified five stages in biface production: (1) obtaining the blank; (2) initial edging; (3) primary thinning; (4) secondary thinning; and (5) final finishing and shaping. The definitions of each stage and affiliated Pinenut artifacts are as follows:

Stage 1 consists of obtaining a suitable blank for production of the biface. This may entail production of a large flake by percussion or procurement of a suitably-shaped nodule of raw material. No specific examples were recognized within the Pinenut collection, though the fact that they were present is obvious.

Stage 2 bifaces are those which exhibit initial edging, where relatively short broad flakes were removed by hard hammer percussion. Edges are very sinuous in outline, and the biface is generally not bilaterally or bifacially symmetrical in this stage. Flake removal is bold, random, and often discontinuous around the circumference of the tool. Three examples of hard-hammer reduced Stage 2 bifaces were identified from the Pinenut collection. Two are complete and one is a snapped midsection.

Measurements:	Artifact 691:	Length:	50 mm
		Width:	37 mm
		Thickness:	11 mm
	Artifact 664:	Length:	57 mm
		Width:	43 mm
		Thickness:	12 mm
	Artifact 811:	Length:	Indeterminate
		Width:	57 mm
		Thickness:	14 mm

Stage 3 bifaces have gone through the primary thinning process in which flakes are struck from the edges in such a way as to continue at least to the midline of the artifact and often undercut flake scars from the opposite edge. In addition, the cross-section becomes regular, lenticular, and thinner in relationship to width than those in Stage

2. Two fragments represent this stage of manufacture.

Measurements:	Artifact 793:	Length:	Indeterminate
		Width:	34 mm
		Thickness:	8 mm
	Artifact 749:	Length:	Indeterminate
		Width:	32 mm
		Thickness:	11 mm

Stage 4 bifaces have been secondarily thinned. In this stage the cross-section of the biface is noticeably flattened by striking flakes which carry considerably beyond the centerline. Overall, Stage 4 bifaces take on a bilaterally symmetrical outline as the knapper begins to bring the biface into a shape anticipating the final tool form. One complete specimen and eight fragments consisting of four tips, three midsections, and one base constitute this category. Most of the fragments display snap fractures, though one broke due to an internal flaw.

Average Measurements:	Length:	Artifact 877:	34 mm
	Width:	Range:	44-14 mm
		Mean:	26.7 mm
		Standard Deviation:	8.7
	Thickness:	Range:	10-5 mm
		Mean:	24.7 mm
		Standard Deviation:	9.5

Stage 5 bifaces have entered the shaping process by preparing the artifact for either use or haft preparation. Maximum attention is paid to the form, even-ness, and symmetry of the bifacial edge. Pressure flaking or very diminutive controlled percussion flaking is usually involved. Nine fragments are included in this stage. Most display final pressure retouch shaping though several were percussion-shaped. Where determinable, general outline is pinnate to subtriangular. Most are relatively thin with a biconvex cross section. Breakage on the fragments is dominated by snap fractures, though one specimen exhibits a perverse fracture as a result of notching.

Average Measurements:	Length:	Artifact 872:	34 mm
	Width:	Range:	35-16 mm
		Mean:	21.5 mm
		Standard Deviation:	5.3
	Thickness:	Range:	8-4 mm
		Mean:	5.2 mm
		Standard Deviation:	1.2

Drills

Two morphological variations of drills occur in the Pinenut assemblage: flanged bifacial drills and modified flake drills. Both types exhibit edge-wear attrition and small bifacial step fractures, suggesting the implements were used in a rotation movement.

Flanged drills include two nearly-complete specimens, a midsection, and a tip fragment (Figures 8.5A, B, C, D). The complete drills were shaped by steep bifacial retouch and display slightly expanding flangs and biconvex cross-sections. Artiface 355 exhibits edge blunting on the basal end to facilitate hafting (Figure 8.5A). Presumably, the others were also either split or socket-hafted. All four drills were made from small bifaces.

The two flaked drills were manufactured on interior flakes with step bifacial retouch used primarily to shape the distal end into an elongated bit (Figures 8.5F, G). These artifacts still retain much of their original flake characteristics. This type of drill was probably hand-held.

Overall Measurements:

Flanged Drills:	Artifact 355:	Length:	47 mm
		Base Width:	15 mm
		Thickness:	5 mm
	Artifact 837:	Length:	Indeterminate
		Width:	Indeterminate
		Thickness:	6 mm
	Artifact 844:	Length:	Indeterminate
		Base Width:	14 mm
		Thickness:	5 mm
	Artifact 845:	Length:	Indeterminate
		Width:	Indeterminate
		Thickness:	3 mm
Flake Drills:	Artifact 840:	Length:	29 mm
		Width:	22 mm
		Thickness:	4
	Artifact 874:	Length:	Indeterminate
		Width:	Indeterminate
		Thickness:	3 mm

Notches

Two artifacts were classified as notches based on the occurrence of a fairly deep and wide semi-circular concavity. In general, the

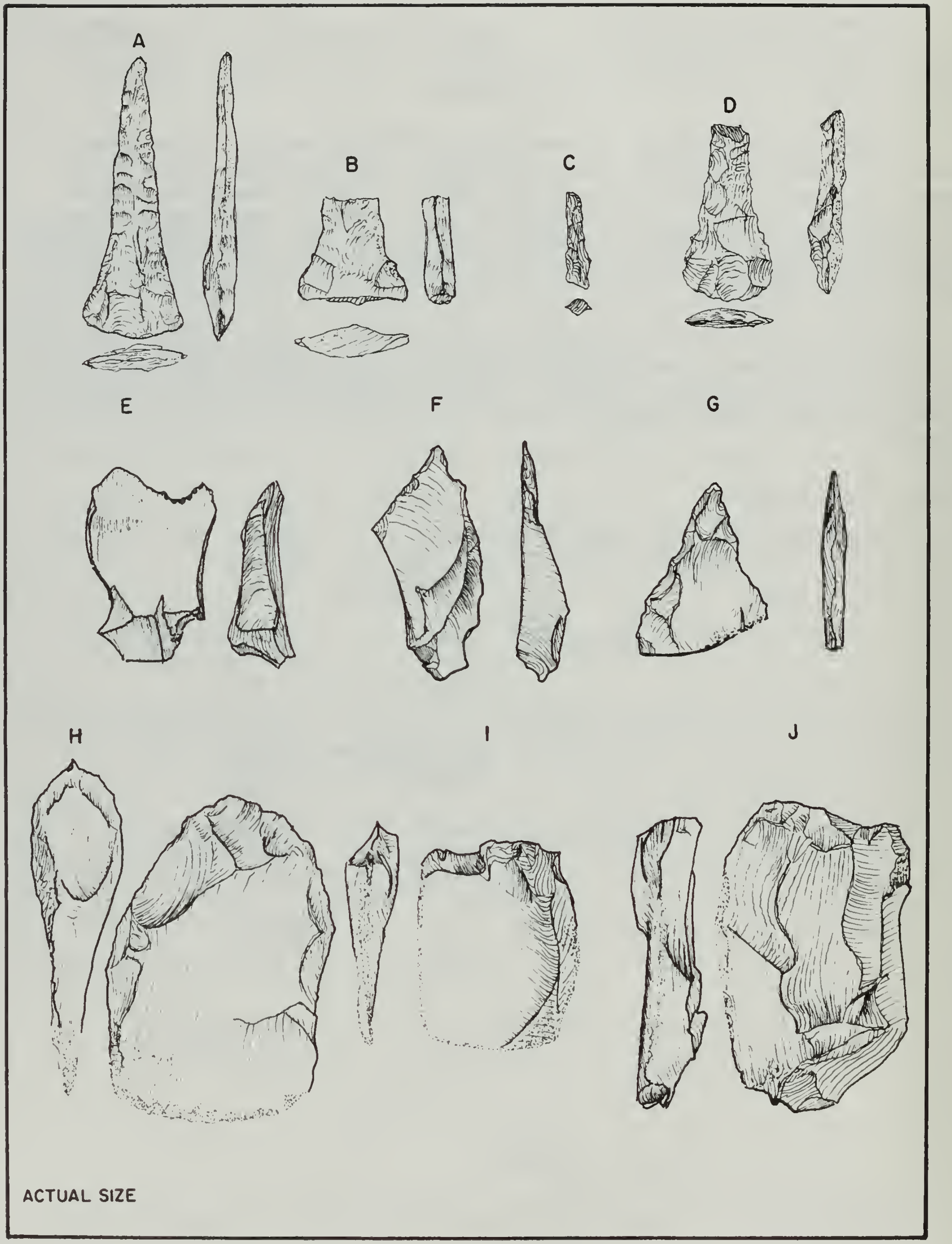


FIGURE 8.5. Flanged Drills: A, B, C, D; Flake Drills: F, G; Notch Tool: E; Edge-abraded Flake Tools: H, I, J.

notch was made by a single percussion blow resulting in the removal of a flake whose scar created a concavity in the edge of the artifact. The notch on one artifact displays light unifacial retouch and the right tip or projection of the concavity exhibits a graver facet (Figure 8.5E). Both artifacts were made on interior flakes and the diameter measurements of the notches are 8 mm and 10 mm.

Artifact 842: Length: 31 mm
Width: 21 mm
Thickness: 12 mm

Artifact 696: Length: 36 mm
Width: 21 mm
Thickness: 5 mm

Gravers/Spurs

The two gravers/spurs exhibit a short but relatively wide projection slightly modified by steep dorsal unifacial retouch along both adjacent margins. Both projections on these two tools have been fashioned from the corner protrusion of a flake. There are no formalized morphological characteristics for these two tools other than the size and strength of the projection. A postulated function of this tool class is the incising of soft material such as wood, hide, or bone (Ahler 1979). Edge-wear damage on the projections was minimal with some unifacial microscarring and minor tip blunting.

Artifact 835: Length: 23 mm
Width: 19 mm
Thickness: 5 mm

Artifact 836: Length: 38 mm
Width: 18 mm
Thickness: 5 mm

Edge-abraded Flake Tools

This artifact type displays one or more highly-abraded edges. Three such tools comprise this type with abrasion occurring on both lateral edges and the distal edge of one flake (Figure 8.5I), the distal end on the second (Figure 8.5H), and on the left lateral flake edge on the third (Figure 8.5J). The abrasion occurs on the edge of the implement, rather than on surfaces adjacent to the edge perimeter. The abraded edge is evenly-round and exhibits a high polish on the dorsal edge face while the ventral edge is slightly flat. The edge-wear pattern runs parallel to the long axis of the edge, indicating use in a backward-forward motion. Abrasion produced experimentally on edges of silicious stone debitage suggests that wear may be the result of incising soft, fine-grained stone (Wheeler 1965). Other possible materials could be antler, bone, or dry wood.

Average Measurements:	Length:	Range:	55-36 mm
		Mean:	48.0 mm
		Standard Deviation:	8.5
	Width:	Range:	38-27 mm
		Mean:	32.0 mm
		Standard Deviation:	4.5
	Thickness:	Range:	15-9 mm
		Mean:	11.3 mm
		Standard Deviation:	2.6

Scrapers

Scrapers are characterized by a convex edge with a flat ventral surface and steep-to-moderately-steep edge angle. These tools vary greatly in techno-morphology, but share use-wear attributes that indicate functional orientation perpendicular to the working edge (Brown, in preparation). Overall, these artifacts are not formal or extensively-formed artifacts but simply flakes or recycled biface fragments exhibiting one or more margins abruptly retouched to some extent. Three broad types of scrapers were distinguished in the Pinenut assemblage based on the position of the retouched edge relative to the longitudinal axis of the tool. These types include end scrapers, side scrapers, and multisided scrapers.

End Scrapers

This is the most common type of scraper with the working edge at either the distal or proximal end of a flake. Six artifacts comprise this type; two are old recycled tools of probable Archaic or earlier manufacture. Three others display a single convex working edge produced by abrupt dorsal retouch at the distal end, while the fourth implement has been retouched on the proximal end. Edge angles on the bits range between 63° to 74°. Edge damage is evident on three of the specimens consisting of edge-rounding and polish with severe step-fracturing present on one implement. The presence of use polish on the implements is tentatively associated with either hide-working or soft wood-working while the step-fracturing damage reflects a more viorous usage (Crabtree and Davis 1968; Semenov 1964; Tringham et al. 1974).

The occurrence of two recycled unifacial end scrapers in the Pinenut Site assemblage represents a phenomenon that is unique to Virgin Anasazi artifact assemblages. Artifact 374 (Figure 8.6A) is a formal patterned end scraper fragment manufactured from a long narrow lenticular flake removed from a discoidal core. The artifact exhibits patterned unifacial retouch on the distal end of the flake with a bit angle averaging 76°. Light unifacial retouch and wear on the lateral margin suggests that the tool may have been hafted. Artifact 825 (Figure 8.6B) is the distal bit fragment of a patterned end scraper which has been truncated laterally by a burin-like blow, possibly an attempt to resharpen the dulled tool

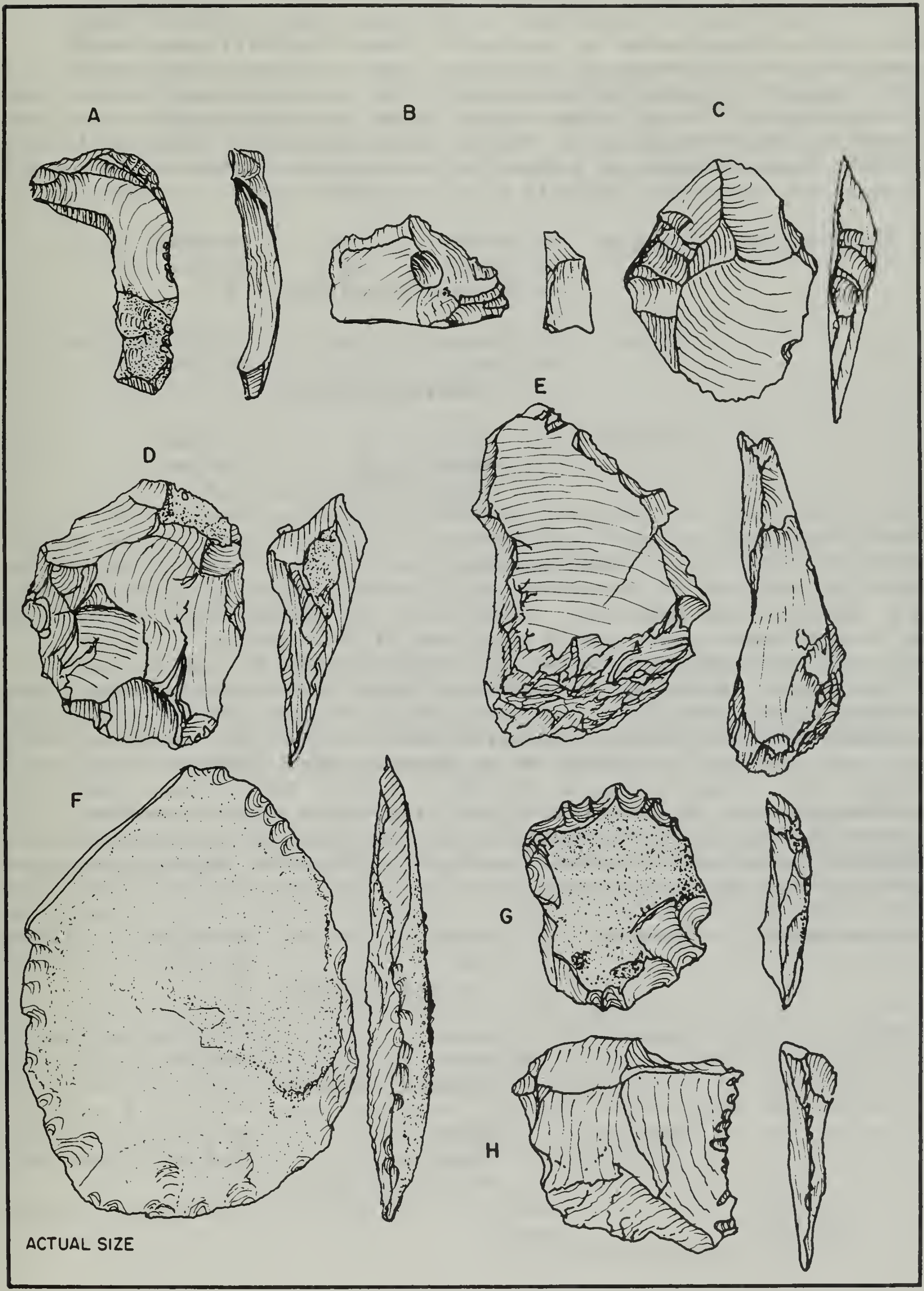


FIGURE 8.6. End Scrapers: A, B; Side Scraper: C: Multisided Scraper: D; Denticulate Tools: E, G, H; Miscellaneous Retouched Flake: F.

edge (Shafter 1970). Both implements exhibit severe edge-wear and analysis was not able to determine if the edge damage occurred from previous use or from re-use at the site. These two artifacts could be ascribed to the PaleoIndian to Archaic temporal span on the basis of their original technological attributes. The scavenging and re-use of old tools appears to be quite common in the Arizona Strip and is documented from both ethnographic (Fowler and Fowler 1981; Fowler and Matley 1978; Stewart 1942) and archaeological contexts (Moffit et al.-1978; Sweeney and Euler 1963; Westfall et al. in press).

Average Measurements:	Length:	Range:	42-38 mm
		Mean:	40.0 mm
		Standard Deviation:	2.0
	Width:	Range:	32-12 mm
		Mean:	22.2 mm
		Standard Deviation:	7.3
	Thickness:	Range:	14-4 mm
		Mean:	8.8 mm
		Standard Deviation:	3.6

Side Scrapers

Side scrapers are essentially similar to end scrapers but differ in that retouch occurs continuously along one of the artifact's lateral margins. For the most part, retouch was accomplished by direct hard hammer percussion resulting in somewhat jagged or irregular edges. Five side scrapers constitute this category, with two made on thick primary decortication flakes, two manufactured on biface fragments, and the last, Artifact 403, made on an interior flake (Figure 8.6C). Edge shapes vary from convex to straight and edge angles range from 49° to 84° with a mean edge angle of 67.2°. All of the artifacts exhibit moderate dorsal retouch, with Artifact 403 displaying slight ventral resharpening. Edge-wear attributes observed on the side scrapers are similar to those on the end scrapers.

Average Measurements:	Length:	Range:	68-40 mm
		Mean:	57.2 mm
		Standard Deviation:	10.6
	Width:	Range:	48-29 mm
		Mean:	40.2 mm
		Standard Deviation:	6.5
	Thickness:	Range:	19-8 mm
		Mean:	14.8 mm
		Standard Deviation:	4.2

Multisided Scrapers

Two scrapers displaying dorsal retouch on more than one edge were classified as multisided scrapers. Artifact 829 was made on an exhausted core with abrupt unifacial retouch 35 to 40 mm long on two opposing concave striking platforms. Edge angles are 75° and 60°. The second multisided scraper, Artifact 827, is made on a secondary decortication flake and displays jagged percussion retouch around a greater portion of the perimeter (Figures 8.6D).

Artifact 829:	Length:	47 mm
	Width:	33 mm
	Thickness:	20 mm
Artifact 827:	Length:	43 mm
	Width:	41 mm
	Thickness:	15 mm

Denticulate Tool

Artifacts showing unifacial retouch along one or more edges consisting of a series of serrated concavitites separated from each other by projections were classified as denticulate tools. Five such artifacts were recognized from the Pinenut Site assamblage on the basis of edge morphology and use-wear.

Two of the specimens exhibit denticulate working edges designed for heavy-duty utilization. Artifact 356 (Figure 8.6G) is a double-ended denticulate manufactured out of the distal end of a large primary decortication flake. The two ends were created by abrupt percussion retouch resulting in slightly jagged, concave working edges.

The other heavy duty denticulate, Artifact 115, was formed by coarse percussion retouch on the right lateral margin of a thick hammerstone resharpening flake (Figure 8.6E). Retouch is irregular and the concavities are wide and deep with jagged projections. Use-wear observed on these two artifacts consists of heavy bifacial microscarring and parallel striations suggesting that the tools may have functioned as saws.

The other three denticulates are not as robust as the two described above and were manufactured from relatively thin interior flakes. Denticulation was accomplished by fine unifacial percussion retouch with serration evenly spaced along the lateral edge of one implement (Figure 8.6H) and only occasional isolated concavities on the other two implements. These tools probably also functioned as cutting/sawing implements, but were used on less resilient substances.

Average Measurements:	Length:	Range:	57-36 mm
		Mean:	46.5 mm
		Standard Deviation:	7.6

Width:	Range:	42-25 mm
	Mean:	32.8 mm
	Standard Deviation:	6.2
Thickness:	Range:	18-5 mm
	Mean:	9.4 mm
	Standard Deviation:	4.6

Miscellaneous Retouched Pieces

Sixteen artifacts displaying minor retouch were classified as retouched pieces. Only artifacts with retouch flake scars 3 mm or more in length were so classified. Most specimens exhibit unifacial retouch, though several were bifacially retouched decortication flakes (Figure 8.6F) and the rest are small biface fragments. Slight to moderate edge-wear consisting of rounding and polish with light microscarring was observed on seven of the tools. Pressure retouch is evident on a few samples, but percussion retouch is most common.

Average Measurements:	Length:	Range:	76-18 mm
		Mean:	38.9 mm
		Standard Deviation:	14.6
	Width:	Range:	55-10 mm
		Mean:	27.3 mm
		Standard Deviation:	11.8
	Thickness:	Range:	16-3 mm
		Mean:	7.8 mm
		Standard Deviation:	3.9

Utilized Flakes

Utilized flakes do not exhibit evidence of intentional retouch but do show edge damage attributable to utilization. Wear patterns consist mainly of microflaking in the form of small short flake scars and/or step fractures, and crushed or dull edges. A fairly conservative approach was taken in edge-wear analysis to include only those specimens that exhibit obvious and easily recognizable edge damage. The intensity of wear patterns identified in this study are considered "pronounced" as compared to "light" or "moderate" (Ahler 1979). Consequently, many flakes which may have been used for working soft, less resistant materials and show only microscopically detectable edge damage have probably been classified as debitage.

Attributes of utilized flakes which were recorded include material type, flake type, and dimentsions (length, width, and thickness). The basis for measuring and interpreting edge angles was derived from Wilmsen (1968) and Semonov (1964). Though oversimplified, edge angles up to 35^{o} to 55^{o} served as general multipurpose tools for cutting and scraping and/or plant fiber shredding, while tools exhibiting edge angles beyond 55° probably served a heavy-duty use.

A total of 135 utilized flakes comprise this group, constituting the most abundant type of tool in the Pinenut Site assemblage. The most utilized flake type is hard hammer secondary decortication flakes (N-74), followed closely by hard hammer interior flakes (N=57). Primary decortication flakes are represented by only 4 specimens. The sample is dominated by complete flakes (83%) with more than half of the fragmentary specimens exhibiting breakage during or after utilization. The material type of all flakes is Kaibab chert, with 7 flakes made of chalcedony.

Up to four utilized edges were noted on specimens, with approximately half exhibiting two working edges, and 40% one working edge. A total of 230 discrete working edges were observed.

Edge angles believed to have been formed during cutting number 111 and display a mean edge angle of 26.4° (standard deviation = 5.6) with a range of 35° to 10°. Multipurpose edges thought to be formed by moderate cutting and scraping tasks number 77 with a mean edge angle of 44.4° (standard deviation = 5.2) and a range of 55° to 36°. Edge angles interpreted as being formed for such heavy-duty tasks as working wood, bone, or heavy plant-shredding total 42 and exhibit a mean edge angle of 65.8° (standard deviation = 6.8) and a range of 84° to 56°.

Overall, these data indicate that a variety of tasks using unmodified flakes were conducted at the Pinenut Site. The functional interpretation of edge angles should be viewed with caution for clearly a detailed microscopic analysis is necessary before any firm conclusions can be drawn. Nevertheless, it is apparent that simple expedient flake tools formed a major part of the lithic tool kit utilized by the Pinenut Site inhabitants.

Average Measurements:

Primary Decortication Flakes:

Length:	Range:	64-49 mm
	Mean:	55.2 mm
	Standard Deviation:	5.4
Width:	Range:	50-33 mm
	Mean:	41.2 mm
	Standard Deviation:	6.9
Thickness:	Range:	28-11 mm
	Mean:	18.2 mm
	Standard Deviation:	6.1

Secondary Decortication Flakes:

Length:	Range:	77-18 mm
	Mean:	43.9 mm
	Standard Deviation:	12.3
Width:	Range:	57-17 mm
	Mean:	31.6 mm
	Standard Deviation:	8.6
Thickness:	Range:	25-3 mm
	Mean:	10.1 mm
	Standard Deviation:	4.0

Interior Flakes:

Length:	Range:	50-14 mm
	Mean:	29.3 mm
	Standard Deviation:	7.6
Width:	Range:	42-14 mm
	Mean:	22.1 mm
	Standard Deviation:	5.6
Thickness:	Range:	10-2 mm
	Mean:	4.6 mm
	Standard Deviation:	1.7

Cores

Two general shape and technological variants were recognized in the small sample of cores. Both variants are directly related to the reduction strategy used in working tabular versus blocky nodules of Kaibab chert. The first and most distinctive subgroup consists of cores made from blocky nodules. These multi-directional flaked cores exhibit random striking platforms on several sides or edges and are blocky, amorphous, or chunky in shape (Figure 8.7A). Unpatterned flaking generally reflects optimization of the specific angles and facets of block-shaped pieces of raw material where flakes are detached from any appropriate platform surface with little concern for core geometry. Seven such cores constitute this group.

The second core morphology consists of four cores made from tabular pieces of stone with a flat edge along one side being used as the striking platform (Figure 8.7B). Flakes were removed by striking directly into the flat platform, producing relatively thick, expanding but flat or uncurving flakes. Cores of this type often exhibit many percussion cones along the flat marginal platforms, and failure of the core due to plunging or overshot flakes is common (Ahler 1986:51).

For both core variants, the primary goal was flake production.

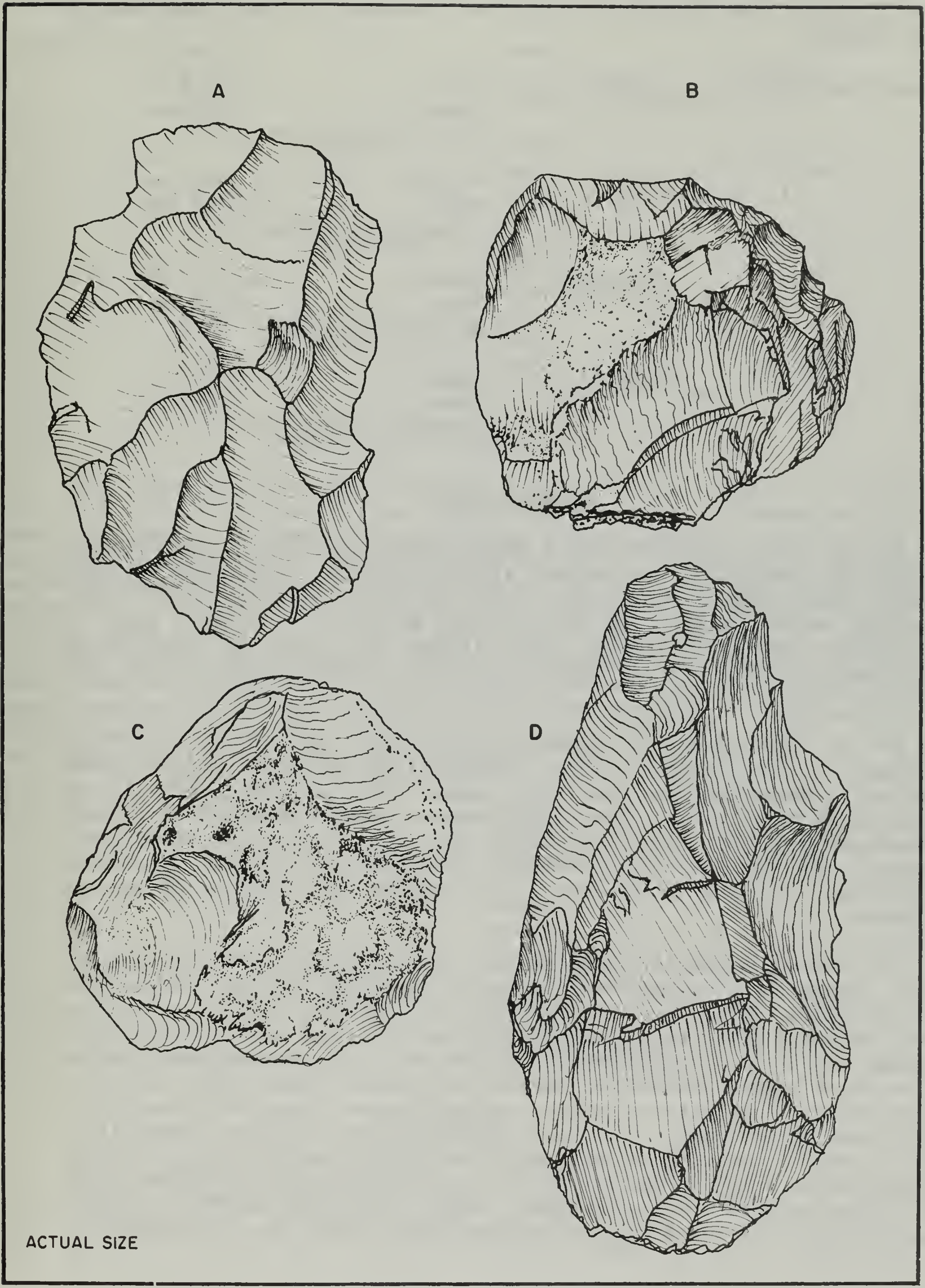


FIGURE 8.7. Cores: A, D; Hammerstones: B, D.

None of the cores inspected exhibit a bifacial morphology suggesting that bifacial tool production was not intended in the reduction of these nodules.

Average Measurements:	Length:	Range:	112-36 mm
		Mean:	69.2 mm
		Standard Deviation:	19.3
	Width:	Range:	57-31 mm
		Mean:	49.9 mm
		Standard Deviation:	8.1
	Thickness:	Range:	49-17 mm
		Mean:	31.9 mm
		Standard Deviation:	9.01
	Weight:	Range:	425.5-28.3 g
		Mean:	154.6 g
		Standard Deviation:	104.2

Hammerstones

The noteable attributes of hammerstones are the varying degrees of abrasion, battering, and severe attrition present along one or more sinuous edges (Figure 8.7B, C). These artifacts were presumably used to pound, mash, hammer, or beat other materials. Although many of the hammerstones are flaked, the flaking was aimed at refurbishing dulled portions and not at producing usable flakes, thus they are not cores.

The 20 specimens are generally palm-sized and reflect a variety of shapes in longitudinal outline ranging from irregular or subrounded profiles to more ovoid or discoidal shapes. The material type selected was conclusively blocky nodules of Kaibab chert displaying a grainy, calcareous texture, often containing numerous crystalized impurities. Normally, this material type exhibits rather poor conchoidal fracturing properties. Cortex is present at an average of 34.5% on 18 of the specimens.

The varying degree of abrasion and battering present on the hammerstones suggest a stone-on-stone contact. Edge utilization ranges from light pecking (with many incipient cones and ring cracks of varying sizes) to heavy battering, pecking, and spalling which usually terminates in hinge and/or step fractures. Well over half of the specimens display one or more blunt, moderately abraded peripheral edges. This abrasion was probably a result of rubbing pecked stones (especially manos) to smooth and finish them or to just maintain their usability (Dodd 1979: 237). Another possible explanation, besides the traditional percussion flaking operation, is the use of these implements to crack and grind small seeds by friction and pressure. Euler and Dobyns mention a similar usage in their 1983 publication on the ethnoarchaeology of Pai milling stones.

Average Measurements:	Length:	Range:	102-65 mm
		Mean:	74.2 mm
		Standard Deviation:	12.7
	Width:	Range:	82-54 mm
		Mean:	62.5 mm
		Standard Deviation:	11.1
	Thickness:	Range:	76-38 mm
		Mean:	47.4 mm
		Standard Deviation:	12.7
	Weight:	Range:	765.4-141.7 g
		Mean:	306.8 g
		Standard Deviation:	193.3

Hammerstone Resharpening Flakes

This category does not represent a specific tool type but rather the byproducts resulting from the resharpening of a hammerstone in order to create a sharp sinuous working edge. All 43 flakes display moderate-to-heavy edge battering, spalling, and abrasion. The use of sharp-edged stones to shape and sharpen ground stone tools has been observed in the Southwest by Bandelier (1966:156, 1970:46), Gifford (1940), Eddy (1964), Lange (1959:174), and Simpson (1952:185). Dodd's replicative experimentation study with battered implements found that sharp sinuous-edged stone tools were well-suited for shaping and maintaining ground stone implements and when blunt, the edges of the tool served several secondary functions such as pulverizing plant and animal materials on a metate or use as a knapping percussor.

Average Measurements:	Length:	Range:	65-21 mm
		Mean:	39.8 mm
		Standard Deviation:	10.2
	Width:	Range:	51-15 mm
		Mean:	30.2 mm
		Standard Deviation:	8.4
	Thickness:	Range:	22-3 mm
		Mean:	10.9 mm
		Standard Deviation:	4.5

Percussors

Three cobbles with evidence of percussion on one or both ends were found lying on and immediately above the living floor of Room E. The raw material utilized was unmodified palm-sized quartzite cobbles. The closest source for obtaining quartzite cobbles is the Shinarump

Cliffs near Fredonia, Arizona, approximately 50 kilometers northeast of the Pinenut Site (Tom Rasmussen, personal communication 1987). In this region quartzite cobbes are readily found eroding out of the basal levels of the Chinle Formation.

Edge damage on the three specimens consists of ring cracks and small battering scars with no evidence of abrasion present. The utilized ends are natural ridges of the stone with no intentionally-manufactured flaked edges. Given their moderate size and average weight (217.3 grams), these implements were probably used as percussors for finely-controlled percussion flaking.

Measurements:	Artifact 815:	Length:	81 mm
		Width:	78 mm
		Thickness:	42 mm
	Artifact 816:	Length:	78 mm
		Width:	47 mm
		Thickness:	20 mm
	Artifact 378:	Length:	Indeterminate
		Width:	74 mm
		Thickness:	35 mm

Hoes/Digging Implements

Nine large digging implements were recovered at the Pinenut Site. Seven were manufactured from elongated spalls of dense well-cemented reddish sandstone (Figure 8.8) and one utilized the natural projection occurring on an irregular sandstone fragment (Figure 8.9). The ninth specimen is a slightly modified tabular chunk of silt limestone. Both raw material types are locally exposed in the Harrisburg Member of the Permian Kaibab Formation.

The elongated spalls have been shaped to varying degrees by crude bifacial flaking along the lateral edges. Five exhibit polish and attrition on both lateral sides at the midcenter point of the artifact indicating they were hafted. Steep bifacially-retouched bits occur on opposing ends of three implements, while the others exhibit only one bit. Edge-wear on the chipped ends is generally severe consisting of crushing, battering, and pitting. Extensive polish is present on the bits of three tools and extends at right angles indicating a drawing motion for use. These artifacts probably functioned as agricultural and/or excavation implements.

Average Measurements:	Length:	Range:	212-129 mm
		Mean:	170.25 mm
		Standard Deviation:	24.9
	Width:	Range:	118-71 mm
		Mean:	97.0 mm

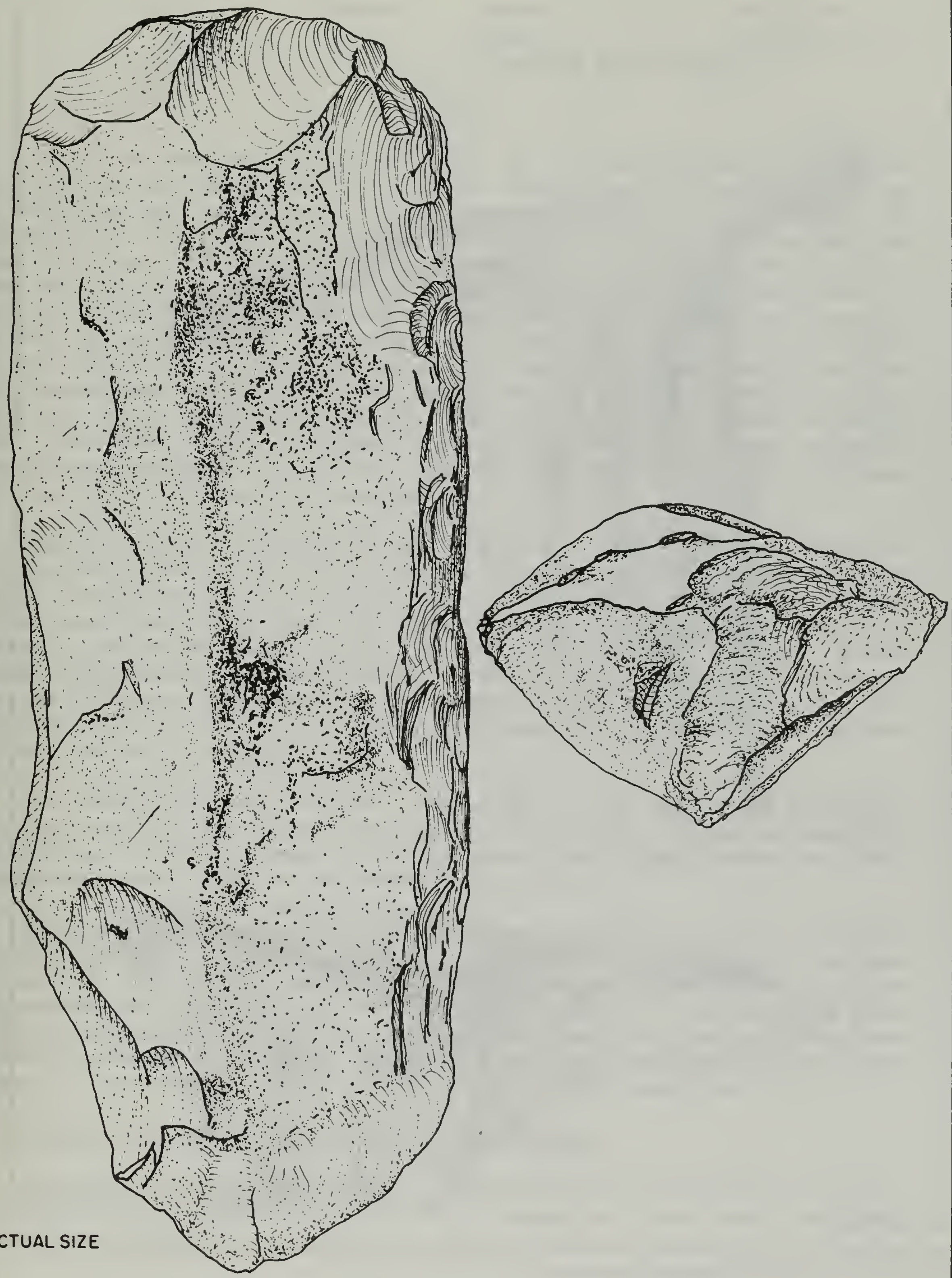


FIGURE 8.8. Hoe/Digging Implement.

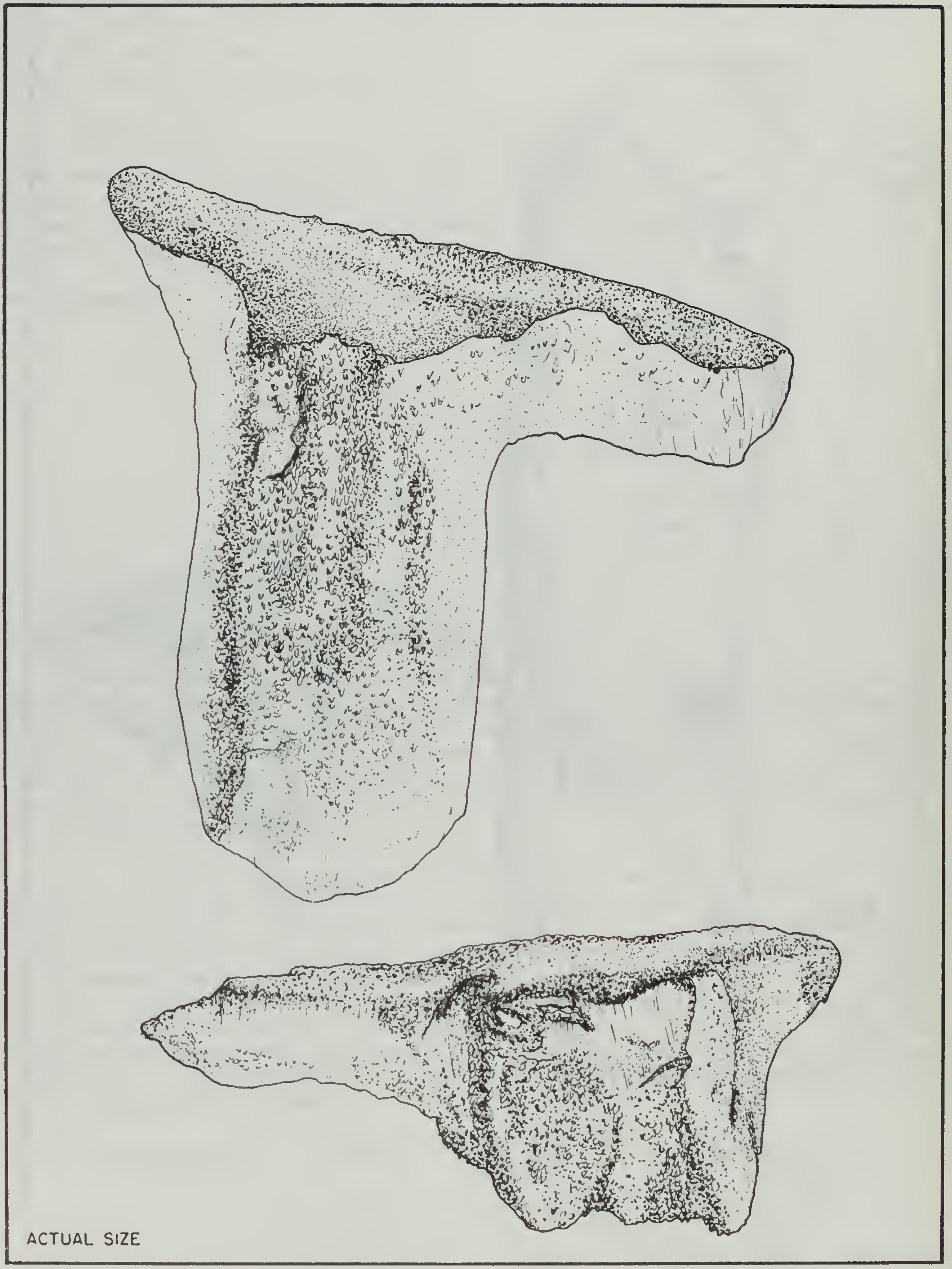


FIGURE 8.9. Hoe/Digging Implement.

Standard Deviation: 15.4

Thickness: Range: 64-21 mm
Mean: 50.2 mm
Standard Deviation: 11.8

Debitage

The term debitage is defined here as the waste material from the manufacture and maintenance of stone tools. A total of 1197 pieces of debitage was recovered during the excavation. The analysis and classification of debitage is organized according to a framework modified from Sullivan and Rozen (1985). In brief, they divide debitage into four main types: complete flakes, broken flakes (exhibiting an identifiable platform), flake fragments (exhibiting an identifiable ventral surface but no platform), and debris (amorphous shatter with no definable ventral surface). In general terms, Sullivan and Rozen (1985) conclude that assemblages weighted on the "complete flake" end of the four-group scale are characteristic of unintensive core reduction, those on debris show intensive core reduction strategies, those on flake fragments denote tool manufacture, and more evenly weighted collections represent both core reduction and tool manufacture.

Modification of Sullivan and Rozen's (1985) model is based on the project-specific factors of the Pinenut collection and consists of the expansion of two of the four categories as follows: complete flakes were subdivided into core flakes (primary and secondary reduction flakes), interior flakes, and finishing/maintenance flakes. Broken flakes displaying an identifiable platform were similarly divided as complete flakes. Finishing/maintenance flakes were lumped into the complete flake category because differences in information content between the two is lacking.

The collection was analyzed according to the following categories of attributes: flake type, platform characteristics, size, and material composition. The categories of flake types are defined below and their subsequent tabulations are presented in Table 8.1.

1. Primary Decortication Flake. A primary flake or spall is usually thick, with the dorsal face being entirely cortex; striking platform is usually at a right angle to the flake axis. This type of flake corresponds to Crabtree's (1972) hard hammer flake and exhibits a large bulb of percussion, strong force rings and fissures, and may sometimes display cracked or crushed striking platforms. Primary decortication flakes are interpreted as the initial stage of core reduction.

2. Primary Decortication Proximal Flake Fragment.

3. Secondary Decortication Flake. A flake with the dorsal face exhibiting minimal cortex with one or more negative flake scars resulting from primary reduction of a core.

TABLE 8.1
Pinenut Debitage Characteristics Per Feature

	FEATURE 1 ROOM BLOCK	FEATURE 2 PIT STRUCTURE	FEATURE 3 SLAB-LINED CISTS	TRASH MIDDEN	SUB-TOTALS	TOTALS
COMPLETE FLAKES						
Primary Decortication Flake	8	9	4	8	29	399
Secondary Decortication Flake	34	91	8	79	212	
Interior Flake	58	45	6	38	147	
Finishing/Maintenance Flake	2	2	6	1	11	
PROXIMAL FLAKE FRAGMENTS						
Primary Decortication Flake Fragment	5	5	2	4	16	265
Secondary Decortication Flake Fragment	11	45	9	61	126	
Interior Flake Fragment	33	42	9	39	123	
FLAKE FRAGMENT	49	95	22	134	300	300
DEBRIS/SHATTER	47	69	22	95	233	233
TOTALS	247	403	88	459	1197	1197

TABLE 8.2
Metric Data For Complete Flakes

	PRIMARY DECORTICATION FLAKES N=29	SECONDARY DECORTICATION FLRAES N=212	INTERIOR FLAKES N=147	FINISHING/MAINTRNANCE FLAKES N-11
LENGTH				
Range	70-15 mm	91-14 mm	55-11 mm	17-9 mm
Mean	35.6 mm	33.8 mm	24.2 mm	13.4 mm
Standard Deviation	12.4	11.6	9	2.5
WIDTH				
Range	47-17 mm	70-11 mm	49-6 mm	13-8 mm
Mean	30.7 mm	27.0 mm	16.8 mm	8.4 mm
Standard Deviation	9.4	10.2	7.6	2.4
PLATFORM THICKNESS				
Range	18-5 mm	25-3 mm	12.2 mm	2-1 mm
Mean	9 mm	8.35 mm	4.2 mm	1.8 mm
Standard Deviation	3.1	3.5	1.7	0.4

4. Secondary Decortication Proximal Flake Fragment.

5. Interior Flake. A flake that displays surfaces free of cortex. Depending on the characteristics of the platform, this type of flake could correspond to either soft hammer thinning of a biface or hard hammer reduction of a core.

6. Interior Flake Fragment.

7. Finishing/Maintenance Flakes. Small interior flakes that are generally 1 cm in maximum dimension. This type of flake is usually associated with the final stage of tool production and/or tool maintenance retouch.

8. Flake Fragment. A flake fragment exhibits an identifiable ventral surface but no platform.

9. Debris/Shatter. Irregularly-shaped, broken or fractured flakes lacking a bulb of percussion, platform, distal flake end, or other attributes characteristic of sequential reduction flakes.

The second variable, "platform characteristics," constitutes the form of the striking platform displayed on a complete interior flake or an interior proximal flake fragment. Our approach to classifying different platform types was very simplistic and consisted of noting the presence of a prepared platform (i.e., faceting and lipping) versus a plain crushed or shattered platform (Sullivan and Rozen 1985). The purpose of this analysis was to determine the degree of soft hammer versus hard hammer secondary reduction.

The third variable is the size of complete flakes and is indexed according to length, width, and thickness. The length of a complete flake is the distance between the point of impact/striking platform and the distal end of the flake. The width is the largest distance between lateral edges as measured perpendicular to the longitudinal axis of the flake. Thickness measurements were obtained by measuring the proximal end of the flake. The resulting tabulations of flake size are presented in Table 8.2.

The selection and variability of raw material types normally constitutes an important variable in debitage analysis. In the Pinenut assemblage, however, the utilized raw material is almost entirely local chert derived from the Kaibab Limestone Formation. The only other raw material present in the debitage assemblage is a brownish-translucent chalcedony which constitutes 1.9% (N=23) of the total. Hence, recordation of raw material was not considered an appropriate variable.

Ground Stone Artifacts

The Pinenut Site yielded a relatively small assemblage of 24 ground stone artifacts. Of these, 22 are recognizable tools and 2 are miscellaneous ground fragments lacking sufficient attributes to permit typological classification. These two fragments are merely cited here for the record and the discussion which follows will address the remaining 22 ground stone implements.

The presence of grinding implements on a site generally indicates the reduction of plant, animal, and mineral resources into a low-bulk size for ease in transport or for immediate consumption or use. Commonly, the co-occurrence of formal manos with metates or grinding slabs are interpreted as grinding tool kits used to process plant materials. As noted in Chapter III grinding tool kits are usually classified into two general categories: those associated with corn-grinding, implying a horticultural subsistence base, and those associated with seed-grinding, implying a subsistence strategy oriented toward wild resource collecting. In the former, the mano and metate tool kit often exhibit formal shaping attributes (Woodbury 1954); the latter, however more often displays a variable range of shaping and use-wear attributes that seem to be related to their more eclectic usage and portability (Westfall 1985c).

The analysis of ground stone artifacts from the Pinenut Site followed the definitions of Woodbury (1954), with modifications adapted from a study by Westfall (1985c) to accommodate artifacts displaying attributes varying from those used by Woodbury. Attributes which were monitored included raw material, form, longitudinal and lateral cross-sections, number of use surfaces, incidental use-wear, presence of end/side battering, and condition (complete or fragmentary). Seven techno-functional classes were identified on the basis of mutually exclusive attributes: one-hand mano, two-hand mano, indeterminate mano type, trough metate, grinding slab, abrading stone, and shaft-smoother. As an independent test of the functional classifications, three grinding implements were submitted to Palynological Analysts, Inc., Denver, Colorado for analyses of pollen washes from the respective grinding surfaces (Scott, Chapter IX, this volume).

One-hand Mano

Artifact 228

The artifact is a natural flat cobble of fine-grained hard pink sandstone that had been pecked to shape around 3 edges to an elongated oval shape. It is biplanar in longitudinal cross-section and plano-convex in lateral cross-section. The mano is unifacially ground; the primary use surface is pitted with pecking scars and ground flat and smooth. The opposite surface exhibits light incidental abrasion. The use-wear attributes indicate usage on a flat abrading surface.

Measurements:		
	Length:	115 mm
	Width:	90 mm
	Thickness:	22 mm

Two-hand Mano

Artifact 233

This is an end fragment of a probable two-hand mano made of fine-grained hard gray sandstone. The perimeter of the cobble was pecked to shape into a sub-rectangular form. The mano is biconvex in longitudinal cross-section and wedge-shaped in lateral cross-section (Figure 8.10). The mano is bifacially ground; the primary use survace is heavily pitted with pecking scars and ground smooth. Use-wear carries slightly over the leading and trailing edges. The opposite surface is also pitted with pecking scars and exhibits light abrasion. The end exhibits only incidental light abrasion. The use-wear pattern on this artifacts indicates usage on a grinding slab with a flat or slightly concave surface, using a slight tilting, reciprocal motion. Secondary use of this fragment as an abrading stone or one-hand mano is indicated by use-wear extending over the fragmented edge on the primary use surface.

Measurements: Length: 100 mm (incomplete)
Width: 95 mm
Thickness: 34 mm

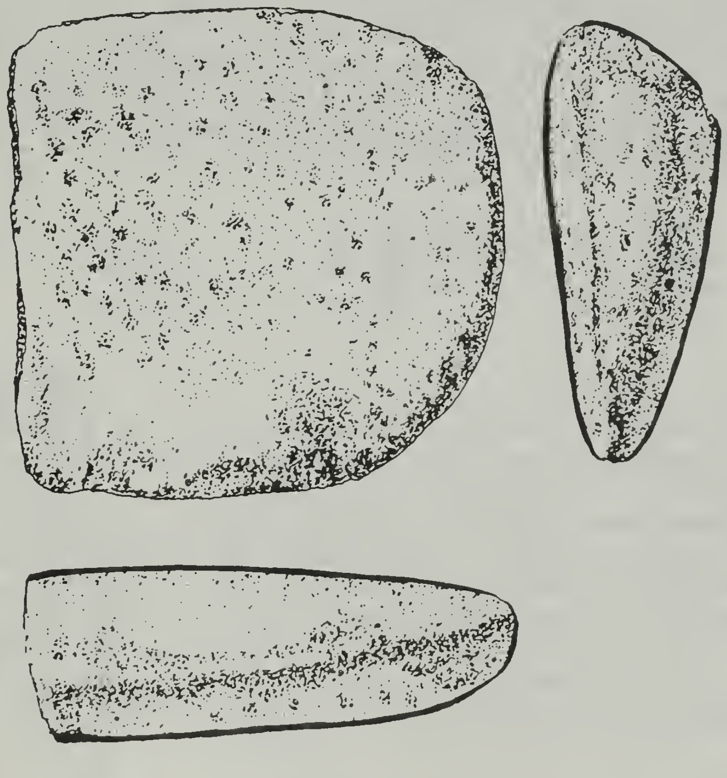


FIGURE 8.10. Re-used Two-hand Mano Fragment; Artifact 233.
Scale: One-half Actual Size.

Artifact 274

The artifact is an end piece of a two-hand mano made of a medium-grained, hard, reddish orange sandstone. It was minimally pecked and flaked to shape from a flat cobble. The artifact is biplanar in longitudinal cross-section and plano-convex in lateral cross-section. The mano is unifacially ground; the use surface is spalled and pitted with pecking scars. The surface is ground smooth with use-wear extending a little over both edges, but no wear extends over the end. The opposite surface is unmodified. The wear pattern probably resulted from use of the mano on a flat grinding surface.

Measurements: Length: 86 mm (incomplete)
Width: 99 mm
Thickness: 22 mm

Artifact 276

This artifact is the only complete specimen of a two-hand mano recovered from the Pinenut Site (Figure 8.11). The artifact was made from a natural flat cobble of fine-grained hard pink sandstone which exhibits no obvious intentional shape modification. It is sub-rectangular in outline and biconvex in both lateral and longitudinal cross-sections. The mano is unifacially ground; the use surface is heavily pitted with pecking scars and ground smooth. Use-wear carries over the leading and trailing edges only slightly, indicating a slight rocking motion during use. The ends are unmodified. The wear pattern indicates usage on a flat or very shallow grinding concavity.

Measurements: Length: 153 mm
Width: 104 mm
Thickness: 37 mm

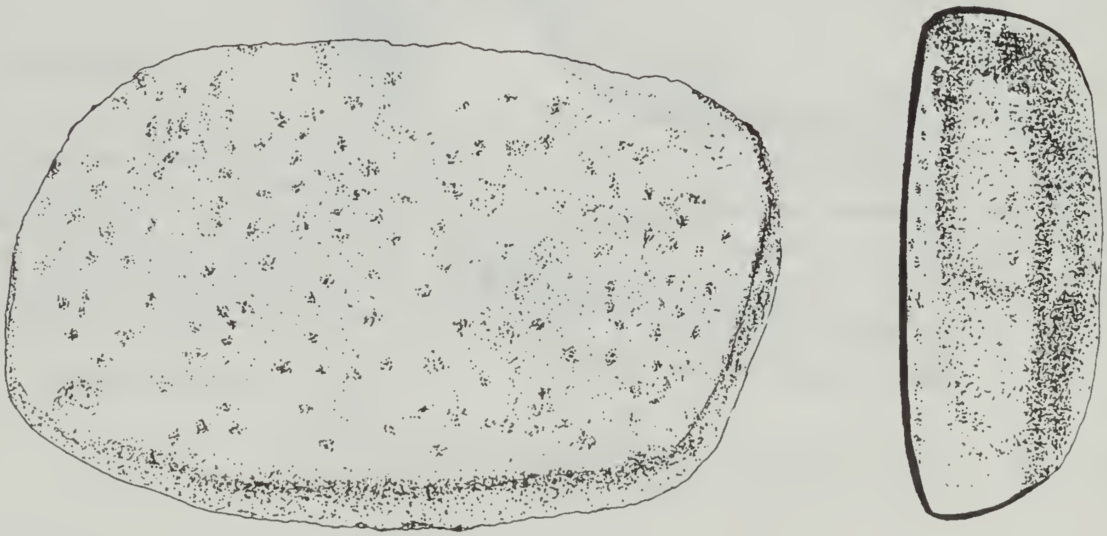


FIGURE 8.11. Complete Two-hand Mano; Artifact 276.
Scale: One-half Actual Size.

Artifact 298

The artifact is an end piece of a two-hand mano made from a coarse-grained grayish-tan sandstone conglomerate. Originally sub-rectangular in outline, it is biconvex in both longitudinal and lateral cross-sections. The mano exhibits slight pecking to shape along both edges. It is unifacially ground; the use surface is pitted with pecking scars and ground smooth. Use-wear extends to the end but does not extend over it, indicating usage on a flat or shallow grinding concavity. Heavy step-fracturing on the end indicates secondary use as a pounding implement.

Measurements: Length: 70 mm (incomplete
Width: 100 mm
Thickness: 32 mm

Artifacts 331 and 346

This mano consists of two pieces which articulate to form two-thirds of a sub-rectangular two-hand mano. The fragments, which came from Rooms C and D, respectively, apparently were recycled into the wall construction of of the rooms. The artifact had been heavily pecked and flaked to a thick, sub-rectangular shape and is plano-convex in both longitudinal and lateral cross-sections. The primary use surface is ground smooth, with use-wear extending a little over both edges; no use-wear was observed on either end. The opposite surface is unmodified save for light abrasion on high points. The use-wear pattern indicates usage on a flat or shallow grinding concavity using a slightly rocking reciprocal motion.

Measurements: Length: 86 mm (incomplete)
Width: 98 mm
Thickness: 35 mm

Artifact 514

The artifact is an end piece of a two-hand mano made from a fine-grained friable tan sandy siltstone. The artifact had been slightly pecked and abraded to a sub-rectangular shape; it is wedge-shaped in lateral cross-section and plano-convex in longitudinal cross-section. The mano is bifacially ground; the primary use surface is pitted with pecking scars and ground smooth, with use-wear extending over the end. The opposite surface is also pitted with pecking scars and ground moderately smooth to a beveled surface. The lateral cross-section and heavier use-wear on the trailing edge indicates tilting of the leading edge of the mano during reciprocal grinding. End-wear suggests usage in a trough metate.

Measurements: Length: 80 mm (incomplete)
Width: 90 mm
Thickness: 30 mm

Indeterminate Mano Type

Artifact 335

The artifact is an end fragment of a mano that lacks sufficient attributes to classify as a one-hand or two-hand mano. The artifact was made of a cobble of coarse-grained multilithic sandstone in a purple iron-manganese matrix. The artifact had been very well-shaped by pecking around the perimeter of the cobble. It is bifacially ground to a plano-convex cross-section. The primary use surface exhibits a few pecking scars and is ground flat and smooth with heavy use-polish evident. The opposite surface is more heavily pitted with pecking scars and is also ground smooth. On both surfaces use-wear extends slightly over the edges, indicating usage in a shallow grinding concavity.

Measurements: Length: 68 mm (incomplete)
Width: 85 mm
Thickness: 24 mm

Artifact 427

The artifact is an end fragment of a mano made of fine-grained friable tan sandy siltstone. It lacks sufficient attributes to permit classification as to type. The edge section is unmodified and the artifact had been unifacially ground.

Measurements: Length: 46 mm (incomplete)
Width: 45 mm (incomplete)
Thickness: 24 mm

Trough Metate

Artifact 656

The artifact is a large side fragment of a trough metate with a deep grinding concavity. It had been made from a naturally thick slab of fine-grained hard gray sandstone. The edges exhibit no modification to shape. It is unifacially ground; the use surface is a 33-mm deep elongated grinding concavity that exhibits moderate pitting from pecking scars and is ground smooth. The opposite surface is unmodified. It should be noted that this metate fragment was used in the wall construction of Room B.

Measurements: Length: 240 mm (incomplete)
Width: 145 mm (incomplete)
Thickness: 80 mm.

Artifacts 307 and 309

Both of these are fragments of an end section of a trough metate that had been used in the wall construction of Room B. The artifact had been made from a slab of fine-grained friable tan sandy siltstone. No edge modification is apparent. The artifact is unifacially ground; the grinding facet is heavily pitted with large pecking scars and the high points are ground smooth. The grinding facet is a portion of what appears to be an elongated oval concavity, measuring 11 mm deep. The grinding surface carries over to the end of the metate, indicating an open-ended metate.

Measurements: Length: 165 mm (incomplete)
Width: 102 mm
Thickness: 42 mm

Grinding Slabs

Artifact 279

The artifact is a side fragment of a grinding slab made from a tabular piece of fine-grained hard pink sandstone. The side is unmodified. The slab is unifacially ground to a slight concavity which exhibits a heavy use-polish. The opposite surface is unmodified.

Dimensions: Length: 80 mm (incomplete)
Width: 52 mm (incomplete)
Thickness: 20 mm

Artifact 623

This grinding slab ("Metate 623" from Room E) is made from a thick angular slab of medium-grained hard pink sandstone. The sides exhibit large spalls that appear to indicate rough flaking to shape. The use surface has been heavily pecked and lightly ground on the margins, suggesting initial use as a flat grinding slab with one closed end and one open end. A deep basin-shaped concavity has been ground into the center, and measures 180 mm long, 145 mm wide, and 55 mm deep. The artifact is fragmented into three large sections, probably as a result of roof and wall collapse onto the slab.

Measurements: Length: 405 mm
Width: 290 mm
Thickness: 87 mm

Artifact 622

The artifact ("Metate 622" from Room E) is an irregular angular slab made of medium-grained gray-pink sandstone. The edges of the slab are unmodified. The use surface is an oval concavity measuring 270 mm long, 180 mm wide, and 13 mm deep. The use-wear pattern indicates both reciprocal and rotary grinding action.

Measurements: Length: 380 mm
Width: 220 mm
Thickness: 120 mm

Artifact 461

The grinding slab is a naturally triangular-shaped flat slab of finegrained hard pink sandstone. The use surface exhibits longitudinal striae and light use-polish from abrasion.

Measurements: Length: 176 mm
Width: 115 mm
Thickness: 40 mm

Artifact 131

The artifact is a side fragment of a grinding slab made from a fine-grained friable tan sandy siltstone. The single use surface had been ground to a slight concavity.

Measurements: Length: 42 mm
Width: 30 mm
Thickness: 30 mm

Artifact 152

The artifact is a corner fragment of a flat grinding slab made from fine-grained hard pink sandstone. The edges of the slab exhibit no shaping attributes. The single use surface displays a few pecking scars and is ground smooth to a flat surface.

Measurements: Length: 86 mm (incomplete)
Width: 80 mm (incomplete)
Thickness: 45 mm

Abrading Stones

Artifact 297

The artifact is a thick square angular cobble of fine-grained hard pink sandstone with one abraded surface. The artifact exhibits no formal shaping attributes. The single use surface is pitted with pecking scars and exhibits light abrasion.

Measurements: Length: 80 mm
Width: 70 mm (incomplete)
Thickness: 60 mm

Artifact 379

The artifact is a naturally flat cobble of fine-grained hard pink sandstone with one use surface. The use surface is lightly pecked in the center and exhibits light abrasion. The opposite surface is unmodified.

Measurements:	Length:	90 mm
	Width:	65 mm
	Thickness:	25 mm

Artifact 17

The artifact is a fist-sized cobble of rough-textured vesicular basalt with angular surfaces. One surface exhibits use polish from light abrasion. This cobble has been split and it is uncertain if this is a complete or fragmentary artifact.

Measurements:	Length:	77 mm
	Width:	60 mm
	Thickness:	70 mm

Artifact 102

The artifact is a rectangular cobble of fine-grained hard pink sandstone with one abraded surface. The use surface is pitted with pecking scars and is moderately abraded. Use-wear extends slightly over two opposite edges, indicating usage in a shallow grinding concavity.

Measurements:	Length:	98 mm
	Width:	75 mm
	Thickness:	65 mm

Shaft-smoother

Artifact 589

This artifact is made from a piece of fine-grained friable tan sandy siltstone. One surface of the stone exhibits two U-shaped grooves. The deeper groove is 40 mm long and 3 mm deep; the shallower groove is 30 mm long and 1 mm deep. The opposite surface is lightly ground flat on a small 45 mm by 50 mm area.

Measurements:	Length:	84 mm
	Width:	58 mm
	Thickness:	37 mm

Summary

Chipped Stone Artifacts

Excavation at the Pinenut Site resulted in the recovery of 344 chipped stone tools and 1197 pieces of debitage. When the lithic assemblage is viewed as a whole, several general observations provide insights into tool manufacture and use. First of all, the debitage count of 1197 in relation to the chipped stone tool count of 344 is an extremely low ratio of approximately 3.5 to 1, suggesting that formal tool manufacture was not one of the main activities at this site. Secondly, the formal tool count of 209, when compared to the utilizied flake count of 135, a ratio of 2.5 to 1, strongly emphasizes the high reliance on expedient stone tools. As further discussed below these two factors, along with the abundance of local Kaibab chert, are the key to interpreting flaked stone tool production at the Pinenut Site.

In descending order of tool production, the acquisition of raw materials suitable for the manufacture of tools appears to have been one based on casual procurement. The almost complete utilization of local Kaibab cherts (98%) indicates that the physical qualities of this stone meet the requirements for the different forms and functions of artifacts and that its availability remained constant. Evidence revealing the reduction state in which the raw material was transported to the site is not clearly discernable. However, the low percentage of primary decortication flakes (6.7%) suggests that initial reduction was performed elsewhere. The eleven multi-directional cores in the assemblage may represent one expedient form of material transportation.

The lithic production technology represented at the site displays two basic stone reduction techniques typical of the Colorado Plateau Anasazi: flaking and pecking (Geib 1985:410). Flaking was the most widely used technique with pecking used primarily for the secondary shaping and finishing of grinding implements. The dominant flaking strategy employed at the Pinenut Site was unstaged hard-hammer percussion, with only minor utilization of soft-hammer percussion. Pressure flaking was also used but was generally confined to edge development of formal tools. The hard-hammer technique is well represented in the debitage assemblage and is distinguished by large bulbs of percussion, strong force rings and fissures on both primary and secondary decortication flakes. In addition, hard-hammer percussion appears to have been the main technique for producing interior flakes from a core. The analysis of platform characteristics on interior flakes revealed that approximately 76% of the 270 flakes exhibited plain crushed and shattered platforms indicating reduction by hard-hammer percussion. The remainder exhibited some evidence of platform faceting and lipping on the ventral surface. These attributes are normally equated with soft-hammer reduction, particularly secondary reduction of a biface (Sullivan and Rozen 1985).

Overall, the composition of the debitage assemblage from the Pinenut Site implies rather unintensive core reduction with emphasis on the production of flakes for direct use. Further modification of these flakes, especially the larger flakes, to produce bifacial tools is evident in the debitage assemblage and to a lesser degree in the formal artifact inventory. However, it would appear that the inhabitants of the site spent relatively less production effort on bifaces.

In conclusion, it appears that the Pinenut Site chipped stone collection is one associated with a mixed subsistence strategy. The diversity of artifacts is taken as ample evidence that a wide range of activities took place during the occupation of the site. Although faunal remains are rare, the presence of projectile points and projectile point fragments indicate hunting activities, while the ancillary tools, such as scrapers and Type I knives, imply game processing. Numerous other small tool types (drills, notches, gravers, denticulates) suggest other activities such as leather, bone or wood processing, many of which could be directly tied into manufacturing critical components of a hunting and gathering tool kit. Tools implying a horticulture-based function are represented by hammerstones and the nine digging implements interpreted as hoes. The hammerstones in particular can be linked to ground stone implement production and maintenance. Altogether, these tools diplayed one or more functional characteristics attributable to a mixed subsistence strategy. However when viewed in tool percentages, the major activities performed at the site were ones where a simple unmodified flake would suffice.

Ground Stone Artifacts

The ground stone tool assemblage from the Pinenut Site can be characterized as basically non-formalized, utilitarian, and small. The majority (86%) of artifacts were fragments. Only one complete two-hand mano and two complete grinding slabs were recovered from the site. This limits the utility of the assemblage for comparative attribute analyses, but several general conclusions can be drawn concerning the function of the assemblage and implications for evaluating the prehistoric subsistence strategy of the Pinenut Site inhabitants.

Three general raw material types were identified: 1) several grades of sandstone in colors of gray, tan, and reddish-orange (n=19 specimens); 2) a coarse-grained purplish sandstone with an iron-manganese matrix (n=2 specimens); and 3) vesicular basalt (n=1 specimen). The first class of sandstones occur locally in weathered exposures of the Harrisburg Member of the Kaibab Limestone Formation. These exposures are common on Water Canyon Point and range from a fine-grained friable tan sandy siltstone that is easily abraded, to a medium-grained, well-sorted quartz grain sandstone in a hard cement matrix. The second class is derived from the Shinarump Conglomerate Member of the Chinle Formation. Since the nearest known exposure of the Shinarump Member is located 50 km. northeast of the Pinenut Site near present Fredonia, Arizona, the occurrence of this rock at the site could indicate acquisition through long-distance exchange or transport. The material also occurs as lag gravels in the plateau canyons, however, and could have been procured from a nearby source. Lastly, the vesicular basalt most likely was derived from the volcanic intrusives near Mt. Trumbull and regions west of the Pinenut Site. Mt. Trumbull is 48 km southwest of Water Canyon Point although smaller volcanic hills such as Heaton Knolls west of the Pinenut Site are situated closer (17 km) and could be another source for basalt.

Two-hand manos (n=6) and grinding slabs (n=6) constitute the most common tool types, while the remainder represent a few specialized tool forms. Noteworthy is the high degree of fragmentation represented in the two-hand manos; for the most part these appear to have been recycled for use as one-hand manos as indicated by use-wear extending over the fragmented edge. It appears that the production and maintenance of formal, two-hand manos was not an important aspect of the ground stone technology of the Pinenut Site; rather, the inhabitants seem to have recycled old, broken tools or simply used locally available tabular rocks that required only minimal shaping.

Grinding slabs were differentiated from metates on the basis of shaping attributes. Grinding slabs were thick flat sandstone slabs whose edges were unmodified and which exhibited a flat-to-basin grinding surface. Scott (Chapter IX, this volume) reports that both domesticated (corn) and wild plant species were processed on grinding slabs; hence it appears that the grinding tool kits at the Pinenut Site were not functionally specialized. Trough metates (n=2) exhibited formal shaping attributes and also had significantly deeper grinding troughs. We do not know, however, if trough metates actually were used in a food processing capacity at the Pinenut Site since the two specimens reported herein were used in the wall construction of Room B in Feature 1. These could have been recycled from a previous artifact assemblage on the site or they could just as easily have been brought in from another site in the near vicinity. However, the possibility that they were used in association with the earlier occupation of the Pinenut Site should not be ruled out. Woodbury (1954) and Brew (1946) have reported that deep, "scoop-shaped" metates are common in the Basketmaker III - Pueblo I time period in the eastern Anasazi region. Hence, the presence of deep trough metates at the Pinenut Site, even in secondary context, implies a possible emphasis on intensive agriculture during the early Anasazi occupation of Water Canyon Point. The implications of this inference will be discussed further in the conclusions to this report.

Table 8.3 shows the distribution of ground stone tool types among the different features at the Pinenut Site. It can be seen that the majority occurred in Feature 1 (the room block) and that the tools are fairly evenly distributed among the rooms. No single room reflects a specialized emphasis on grinding such as mealing rooms which are common in the eastern Anasazi region, although it is noteworthy that only Rooms A and E contain grinding slabs. This is thought to reflect the use of these rooms as areas where food preparation occurred; their presence complements the flaked stone assemblages in each of these rooms, indicating generalized household activities.

TABLE 8.3. Distribution of Ground Stone Tools at the Pinenut Site.

		Mano: 1-hand	Mano: 2-hand	Mano: Indeterminate	Trough Metate	Grinding Slab	Abrading Stone	Shaft-smoother	Total
Feature 1 -	Room A		2			1			3
	Room B		1		2*		1		4
	Room C		1	1					2
	Room D		(1)						(1)
	Room E					2	1		3
	Room F			1					1
	Exterior	1	1						2
Feature 2			1			1			2
Feature 3								1	1
Feature 4						2	2		4
Total:		1	6	2	2*	6	4	1	22

* Indicates trough metate fragments used in wall construction.

(1) Mano fragment in Room D articulates with fragment in Room C; not counted in total.

Feature 2, the pit structure, appears to have been cleared out at the time of abandonment and subsequent artifact deposition may not realistically reflect activity areas. However, a single mano and a grinding slab were found on the floor propped up against the inner wall and could be in situ tools. If such is the case, complementary pollen and flotation data suggest that a variety of wild plant species as well as corn were processed in Feature 2. Thus, the absence of formalized grinding tools and evidence of mixed subsistence resources implies a domicilary function for Feature 2.

Finally, the overall low frequency of grinding tools at the Pinenut Site indicates that the processing plant resources was not an intensive activity. It is probable that the tool kits represent the preparation of minor amounts of food for immediate consumption over a relatively short period of time. If such was the case, the non-specialized functional attributes of the grinding tool kits, contrasted with the large storage capacity of the Pinenut Site suggests that plant foods were stored in bulk for transport elsewhere, rather than consumed on the site. Instead, only a relatively minor amount of stored foods (e.g., corn) were processed and consumed at the Pinenut Site, and these were probably balanced by wild plant foods. Altogether, the ground stone artifact assemblage at the Pinenut Site and the complementary subsistence data reflects episodic, perhaps seasonal, short-term use of the site as a base for a small family group who practiced a mixed subsistence strategy that incorporated horticulture and wild plant gathering.

CHAPTER IX

THE PINENUT SITE POLLEN ANALYSIS

by

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Introduction

Twenty samples were submitted for analysis from the Pinenut Site, a Virgin Anasazi site located in the Arizona Strip. While evidence of both horticulture and wild resource procurement has been noted for the Virgin Anasazi, the degree of reliance on agricultural resources has not been studied. The major research focus of the archaeological study, of which this analysis is a part, is the identification of the function and role of the Pinenut Site within the context of Virgin Anasazi adaptational strategies. All of the subsurface pollen samples submitted for analysis represent features or structure floors. These samples were collected primarily to assess the vegetal portion of the subsistence base, as reflected in the pollen record. In addition, some very general interpretations concerning the environment may be made from this pollen record.

The Pinenut Site is situated at an elevation of 5440 feet on the south side of Hack Canyon. Hack Canyon drains into Kanab Creek, a major drainage approximately 5 miles east of the Pinenut Site. The site is located in an ecotone; open pinyon-juniper woodlands are on the ridges above the site and a sagebrush-grassland community grows in a shallow trough below the site.

Three major architectural features and a sheet trash midden were excavated at the Pinenut Site. Feature 1 consists of a six-room single-story room block composed primarily of storage rooms, with a single living room and a semi-enclosed ramada. Feature 2 is a pit structure located southeast of the room block. Pollen samples were collected from all three major architectural features, and from the trash midden.

Methods

The pollen was extracted from soil samples submitted by Abajo Archaeology from the Arizona Strip in Arizona. A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is low.

Hydrochloric acid (10%) was used to remove calcium carbonates present in the soil, after which the samples were screened through 150 micron mesh. Zinc Bromide (density 2.0) was used for the flotation process. All samples received a short (10 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were then acetolated for 3 minutes to remove any extraneous organic matter.

A light microscope was used to count the pollen to a total of 100 to 200 pollen grains at a magnification of 430x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen, and may be interpreted to represent pollen dispersal over short distances, or the actual introduction of portions of a plant into an archaeological setting. Aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the pollen diagram.

Ethnobotany

Ethnobotanic references provide descriptions of the utilization of various native and cultivated plants by modern Pueblo Indians. A brief description of the plants that appear to have been exploited is reviewed to provide a background for the interpretation of economic pollen and macrofloral records from the Pinenut Site.

Juniperus (juniper) berries have been exploited historically as a source of both food and medicine while the wood was used as fuel and construction material. Juniper berries were an abundant crop and available throughout the year. Goodwin (1935:62) and Gallagher (1977:28-29, 122) note that juniper berries were an important food for the Apache. The berries were eaten fresh, boiled, pounded to form a kind of bread, or soaked and pounded to make a liquid drink. Smith (1974) reports that the northern Utes rubbed juniper berries with a mano to separate the seeds from the pulp. The pulp was then either eaten fresh or dried and ground on a metate. Harrington (1967:242-244) notes that Rocky Mountain juniper berries were collected in the late summer or fall and may have been eaten raw or cooked (boiled or roasted). Dried berries were stored for winter use, when they may have been ground into meal and used to make mush, cakes, or a beverage. The berries may also have been used to flavor meat (Harrington 1967:242; Angell 1981:96). In the greater Southwest, the berries were eaten with piki bread, cooked in stew, boiled, roasted, or dried and ground to form a meal, which may have been used in various cakes (Colton 1974:330; Cushing 1920:243, 255; Whiting 1939:62). Juniper berries have also been used to make a decoction for use as a medicine (Densmore 1974; Gilmore 1977). A medicinal tea was also made from the leaves (stems and scales) (Beaglehole 1937:71; Robbins et al. 1916:39-40; Stevenson 1915:55, 93).

Juniper bark was used to line pits where dried fruits were stored (Chamberlin 1964:372). Juniper is noted to have been used as a fuel and for construction, and the bark as tinder in the greater Southwest (Colton 1974:330; Robbins et al. 1916:39-40; Stevenson 1915:55, 93; Whiting 1939:62).

Pinus (pine) nuts, particularly pinyon pine nuts, were widely exploited historically. The nuts were harvested in the fall or early winter, and a bumper crop was expected approximately every seven years (Harrington 1967:323). The nuts were usually collected when the cones opened and the seeds fell to the ground. If the cones were not open, they were roasted to open them. The seeds were eaten raw or roasted and were frequently roasted prior to storage. Roasting the nuts preserved them for storage and prepared them for grinding into meal (Colton 1974: 347; Gallagher 1977:37-39; Nequatewa 1943:18; Whiting 1939:63). Once the seeds were roasted, they may have been cracked between rocks, such as a mano and metate, and the hulls winnowed out. Pine needles have been used to make tea, and the inner bark may have been used as a starvation food. The bark may have also been dried and ground into meal (Harrington 1967:323). Pine was also used for fuel (Robbins et al. 1916).

Cheno-ams, including Chenopodium (goosefoot) and Amaranthus, (pigweed) were used primarily as food. The greens may be harvested and cooked either alone or with other food, or packed around yucca fruits when they are baked. The seeds were also ground into meal and frequently mixed with cornmeal (Colton 1974:300; Cushing 1920:244-245; Nequatewa 1943:19; Stevenson 1915:66; Whiting 1939:73-74).

Cleome (beeweed) was used both as a food and a pottery paint. The young plants were usually gathered and boiled for food. Both the young and older plants may have been gathered and the entire plant boiled until the water was thick and black. This fluid was then dried and made into cakes, which would keep an indefinite period. The cakes could be soaked in water to be used for paint, or soaked and then fried in grease to be eaten. The seeds would also be gathered and ground in meal, although utilization as a potherb appears to have been more common (Harrington 1967:72; Robbins et al. 1916:58-59; Stevenson 1915:69, 82; Whiting 1939:77-78). Cleome is noted to have been allowed to grow in gardens with cultivated plants. At the Hopi village of Hano, it was named with the three chief cultivated plants: corn, pumpkin, and cotton (Whiting 1939:77-78).

Helianthus (sunflower) is a member of the morphological pollen group of High-spine Compositae. Sunflower seeds are very rich in oil, and may be ground into paste for batter or roasted and eaten. Other members of the Compositae family were used in a variety of ways, including medicinally and as food. Among the Hopi, rabbitbrush (Chrysothamnus) is noted to have been used as one of the four kiva fuels. The plant was also a source of both yellow and green dye. Snakeweed (Gutierrezia) was used medicinally and also as a paho (prayer stick) decoration (Whiting 1939:94-99).

Several members of the Cruciferae (mustard family) are noted to have been exploited for their greens, which were used as potherbs while the plant was young. In addition, seeds may have been parched, ground into flour, and used for making pinole, mush, bread, and to thicken soup (Harrington 1967:308). Tansy mustard (*Descurainia*) greens were eaten in the spring, or used to make pottery paint. Tansy mustard seeds may also have been parched and ground into meal (Colton 1974:309-10; Harrington 1967:307; Stevenson 1915:60).

Members of the Gramineae (Grass family) are noted to have been exploited for seeds, which were ground and used for a variety of mushes, bread, and cakes. *Sporobolus* (drop-seed) and *Oryzopsis* (rice grass) appear to have been the most widely used (Colton 1974:338,365; Cushing 1920:219,253-254; Whiting 1939:65). Various grasses also were used in the manufacture or decoration of pahos (Whiting 1939:65-66).

Members of the Liliaceae (Lily family) that were most commonly exploited include *Allium* (wild onion), *Calochortus* (sego lily), and *Yucca* (yucca). Wild onions may have been consumed raw or used as flavoring, and dried for preservation (Beaglehole 1937:69; Cushing 1920:227; Nequatewa 1943:20; Robbins et al. 1916:53, 110; Whiting 1939:70). Sego lily roots were eaten, frequently raw, and the seeds and flowers ground to make "yellow pollen" (Colton 1974:297; Whiting 1939:70). No evidence of yucca was observed in the pollen record at this site.

Opuntia (prickly pear cactus) and *Cylindropuntia* (cholla cactus) were utilized, frequently in similar ways. The fruits of both cacti were eaten, often boiled. The fruits may also be dried and ground into meal. The buds of cholla cactus are noted to have been gathered, cooked, and eaten, while the pads or joints of prickly pear cactus were boiled and eaten, frequently with syrup (Beaglehole 1937:70; Nequatewa 1943:18-19; Robbins et al. 1916:62; Stevenson 1915:69; Whiting 1939:85-86). *Mammillaria* (pincushion cactus) resembles *Echinocactus* (ball cactus) both in form and in having small seeds. Ethnographic accounts for the use of *Echinocactus* include reference to the use of the fruit, stems, and seeds for food. The small black seeds, when parched and ground, are noted to make good bread or mush (Bye 1972; Castetter 1935; Palmer 1871).

Members of the Solanaceae (Potato family), primarily *Solanum* (wild potato) and *Physalis* (ground-cherry), were exploited for food. The berries of both plants are edible, as are the roots of *Solanum* (Robbins et al. 1916:59,70-73; Stevenson 1915:70; Whiting 1939:90). Wild potato is noted to have been allowed to grow as a weed in otherwise carefully tended agricultural plots (Whiting 1939:16).

Sphaeralcea (globe mallow) root was used medicinally and to make a paint. A tea may be made from the boiled root (Colton 1974:362-363; Robbins et al. 1916:61; Stevenson 1915:98; Whiting 1939:85). With the exception of *Gossypium* (cotton) other members of the Malvaceae family are usually not mentioned in the ethnobotanic studies as having been economically exploited.

Members of the Unbelliferae (Parsley family), including but not limited to Cymopterus (parsnip), Lomatium (biscuit-root), and Pseudocymopterus, are noted to have been used. The roots, stems, and leaves of these plants may have been used for food, seasoning, and medicine (Colton 1974:305; French 1971:385-412; Whiting 1939:86).

Zea (Corn) has been an important cultivated food, for which innumerable ways of preparation exist. The kernels may be parched, soaked in water with juniper ash, and boiled to make hominy. Dried kernels may be ground into meal, which is used as a staple. Cornmeal may be colored with Atriplex (saltbush) ashes. Black corn was used as a dye for basketry and textiles and as a body paint. Whole ears may be boiled and eaten. Corn was frequently husked immediately upon harvesting, limiting the quantity of corn pollen introduced into archaeological proveniences. Seed corn retains a few inner husks, and clean husks are saved for smoking and other uses, such as wrapping food. The ordinary ears were allowed to dry on the roof. Ristras of corn were hung inside from the roof (Cushing 1920:264-267; Robbins et al. 1916:83-93; Stevenson 1915:73-76; Whiting 1939:67-70). "Corn appears in virtually every Hopi ceremony either as corn meal, as an actual ear of corn, or as a symbolic painting" (Whiting 1939:67).

Discussion

Feature 1, the six-room surface room block, appears to have been constructed in three phases. Rooms A, B, and C at the south end of the structure were constructed first; then Rooms E and F were added on to the north. Room D appears to be the last room added to the pueblo. Rooms B, C, D, and F represent storage rooms, while Room E functioned as a living room. Room A is the semi-enclosed ramada. Pollen samples were collected from the floors of the storage rooms as floor scrape samples (Table 9.1). Transects spaced 10 cm apart were sampled across the floor to generate a single composite sample from the floor of each storage room. Areas of the floor exhibiting rodent disturbance were not sampled for pollen. Samples removed from Room E, the living room, were collected from several spot localities, including beneath two metates. The sampling within this series of rooms was designed to address which food products may have been stored within the storage rooms, and what type of subsistence activities were carried out within Room E and Room A.

Four pollen samples were collected from the floors of Storage Rooms B, C, D, and F, Samples 595, 597, 598, and 605 respectively. Rooms B, C, and D exhibit small quantities of Zea pollen (Figure 9.1, Table 9.2), which may reflect the storage of Zea within these rooms. Only Room C yielded a high quantity of Cheno-am pollen, accompanied by a large quantity of aggregates of this pollen type. This indicates that Cheno-ams were also stored in this room. Room D also exhibits a large quantity of Cheno-am aggregates. However, it was not accompanied by a large quantity of this pollen type. It is possible that Cheno-ams were also stored within this room. Rooms B and D both exhibit small aggregates of High-spine Compositae, which may be associated with the storage of a member of this family, possibly sunflower, in these rooms. Storage Room F displays a Cheno-am frequency similar to those recovered in Room E, suggesting that this resource may have been stored in this room. A single grain of Cruciferae pollen was observed in this room, suggesting that a member of the mustard family may have been stored. A small quantity of Typha pollen was also recovered, suggesting that cattails were present in the vicinity of the site, and that they may have been stored in this room.

The ramada (Room A) exhibited two floors; Floor 1 and Floor 2. A composite sample was collected on Floor 2, while Floor 1 is represented by a mano wash (Sample 275). These samples are relatively similar to one another in pollen content. The most notable differences between these samples include the presence of Zea pollen in the mano wash sample, and the presence of small quantities of Plantago and Polygonum pollen in the mano wash sample. Both samples exhibit small quantities of Typha pollen, although different species may be represented, as a single Typha grain was recovered from the mano wash, while a tetrad of Typha pollen was recovered from the floor sample. This suggests that both Typha angustifolia and Typha latifolia may have been growing in a nearby riparian habitat. The Zea pollen recovered in the mano wash sample indicates that corn was probably ground using this tool.

TABLE 9.1. Provenience of Pollen from the Pinenut Site.

Sample No.	Feature No.	Room No.	Provenience	Pollen Counted
626			Modern surface sample	200
593	1	A	Floor 2	200
275	1	A	Floor 1 (Mano wash)	200
595	1	B	Floor	200
597	1	C	Floor	300
598	1	D	Floor	200
599	1	E	Floor beneath Metate 623	200
623	1	E	Metate 623 (Pollen wash)	100
604	1	E	Floor beneath Metate 622	200
622	1	E	Metate 622 (Pollen wash)	200
600	1	E	Floor beneath slabs north of firehearth	200
602	1	E	Directly exterior to east entryway	200
605	1	F	Floor	200
606	2		Floor, SW quadrant	200
607	2		Floor, NE quadrant	200
612	2		Floor beneath ventilator slab	200
616	3-A		Floor 2	200
613	3-B		Floor	200
621	3-C		Floor	200
624			Trash midden (9S/10E) pollen wash of basin metate	212

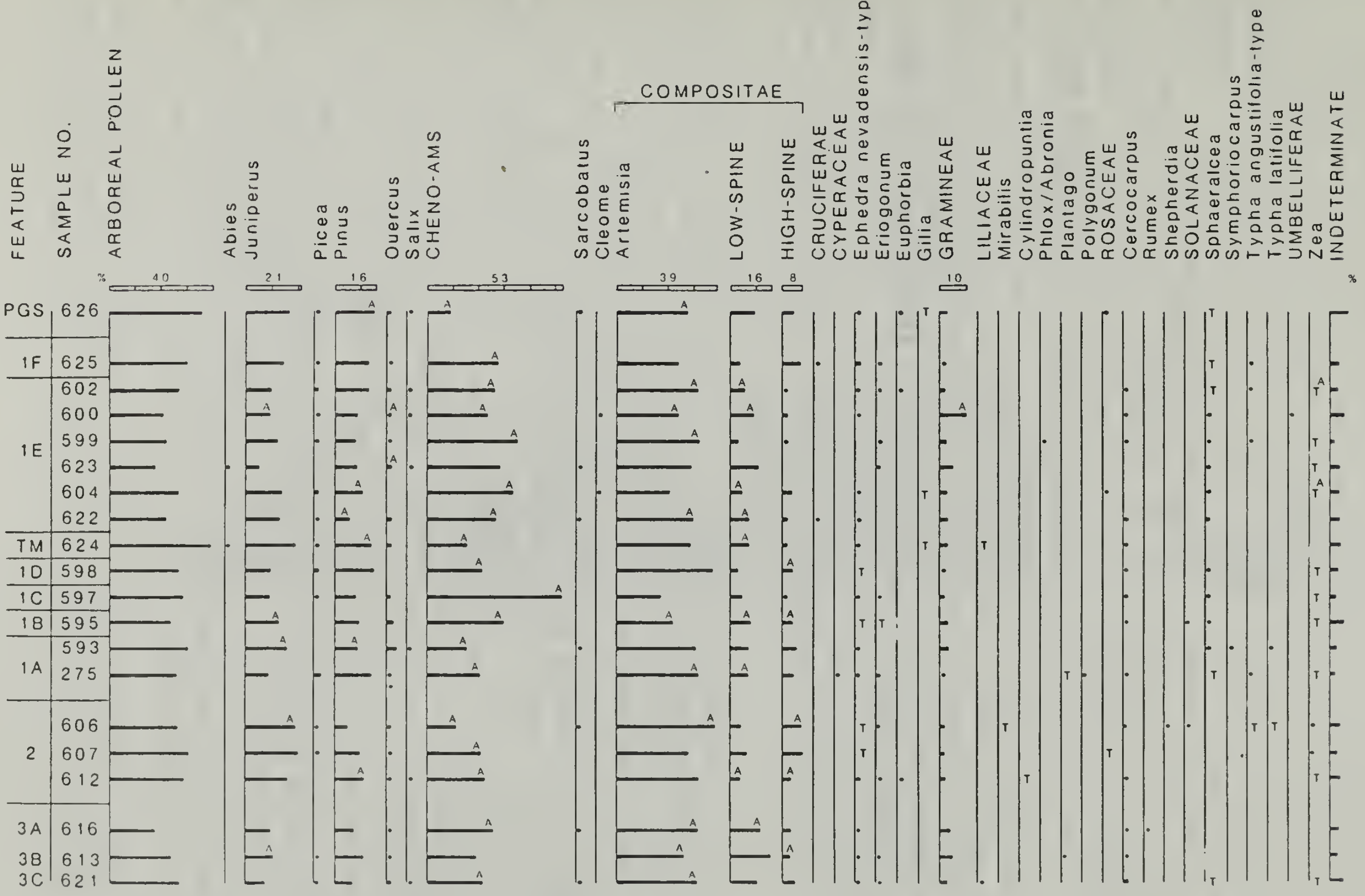

Figure 9.1. Pollen Diagram from the Pinenut Site.

TABLE 9.2. Pollen Types Observed in Samples from the Pinenut Site.

Scientific Name	Common Name
ARBOREAL POLLEN:	
Abies	Fir
Juniperus	Juniper
Picea	Spruce
Pinus	Pine
Quercus	Oak
Salix	Willow
NON-ARBOREAL POLLEN:	
Cheno-ams	Includes goosefoot and pigweed family
Sarcobatus	Greasewood
Compositae:	Sunflower family
Artemisia	Sagebrush
Low-spine	Includes ragweed, cocklebur, etc.
High-spine	Includes aster, rabbitbrush, snakeweed, sunflower, etc.
Cruciferae	Mustard family
Cyperaceae	Sedge family
Ephedra	Mormon tea
Eriogonum	Wild buckwheat
Euphorbia	Spurge
Gilia	Gilia
Gramineae	Grass family
Liliaceae	Lily family
Mirabilis	Wild four o'clock
Cylindropuntia	Cholla cactus
Phlox/*Abronia*	Phlox/Sand verbena
Plantago	Plantago
Polygonum	Knotweed
Rosaceae	Rose family
Cercocarpus-type	Mountain mahogany
Shepherdia	Buffaloberry
Solanaceae	Potato/tomato family
Sphaeralcea	Globe mallow
Symphoricarpos	Snowberry, buckbrush
Typha	Cattail
Umbelliferae	Parsley or carrot family
Zea	Corn

Room E is represented by a suite of samples collected from the floor beneath Metates 623 and 622, the floor to the north of the firehearth, pollen washes collected from Metates 623 and 622, and the living surface outside the room in the vicinity of the east entrance. The sample collected from the area immediately outside this room at the east entryway exhibits pollen similar to many of the pollen samples collected from this room block. A moderate quantity of Cheno-am pollen was present, accompanied by a few aggregates of this pollen type. The *Artemisia* frequency was relatively high, and accompanied by a few aggregates. *Typha angustifolia* pollen was present in small quantity in this sample. A small quantity of *Zea* pollen was also recovered, as was a small aggregate, representing at least transport of this resource through this area. It should not be ruled out that an area in front of this room may have been used in processing subsistence items.

The sample collected to the north of the hearth (600) is similar to that from the entryway, with the exception that a large quantity of Gramineae pollen was recovered, as well as aggregates of this pollen type. This suggests that grasses, probably grass seeds, were processed in the area near the hearth. Single grains of *Typha angustifolia* type and Umbelliferae pollen were also recovered from this location, and may also represent subsistence activity. A small quantity of *Cleome* pollen was recovered from this sample, also suggesting that this resource was processed in the vicinity of the hearth.

Sample 599 represents the floor beneath Metate 623, while Sample 623 represents the wash collected from the ground surface of Metate 623. These samples are similar to one another and to other samples collected from the room block. Both the floor and metate wash sample exhibit small quantities of *Zea* pollen, suggesting that corn was processed in this area of the structure, probably using Metate 623. Sample 599 representing the floor beneath the metate also yielded a small quantity of *Typha angustifolia* type pollen, suggesting that cattails may have been processed using this metate. Sample 604 represents the floor beneath Metate 622, while Sample 622 represents the wash collected from the ground surface of Metate 622. The floor sample exhibits a large quantity of aggregates of Cheno-am pollen, a small quantity of *Cleome* pollen, and a small quantity of *Zea* pollen accompanied by an aggregate. These pollen types are probably associated with the processing of these resources in the south half of Room E. The wash sample collected from the ground surface of Metate 622 did not exhibit either *Cleome* or *Zea* pollen. Nor did it contain large aggregates of Cheno-am pollen, although a small quantity of Cruciferae pollen was recovered. This sample did not display conclusive evidence of grinding foods on Metate 622.

Sample 624 was collected from the trash midden to the east of the room block (Feature 1). This sample displayed a relatively small quantity of Cheno-am pollen, as well as few aggregates of this type.

Artemisia pollen was abundant in this sample, which also displayed a higher frequency of total arboreal pollen than has been observed throughout the samples representing occupation. It is similar to that of the present ground surface, indicating that during the time of occupation the pinyon/juniper community may have been similar to that of the present in size, density, and perhaps location or proximity to the site. A small quantity of Liliaceae pollen was recovered from this sample, suggesting that a member of the Lily family may have been discarded within the trash midden.

Feature 2 is a pit structure located southeast of the room block. This structure may have been contemporaneous with Rooms A, B, and C, the earliest rooms constructed in the room block. It is possible that this pit structure was abandoned near the time of construction of Room E. Three pollen samples were collected from small areas of the floor that retained its plaster. Sample 606 represents the southwest quadrant, 607 the northeast quadrant, and 612 the floor beneath the ventilator slab. The general pollen distribution within this pit structure is similar to average quantities yielded from the surface rooms. Relatively small quantities of Cheno-am pollen accompanied by a few small aggregates were recorded throughout the pit structure. A large quantity of *Artemisia* pollen was recovered in the southwest quadrant of the floor, and was recovered by a few small aggregates. Both *Shepherdia* and Solanaceae pollen were recovered in small quantities on this area of the floor, as were *Typha* *angustifolia* type and *Typha* *latifolia* pollen. It is possible that numerous native plants including *Shepherdia*, Solanaceae, and *Typha* were processed in this portion of the pit structure. *Zea* pollen was recovered from all of the samples collected within this pit structure, indicating that corn was also processed there. A small quantity of *Cylindropuntia* pollen was observed during the scan of this slide, indicating the availability of this resource to the occupants of the site, and its probable utilization and processing within the pit structure.

Feature 3 is a cluster of slab-lined cists located to the west of the pueblo. Pollen samples were collected from each of the cists. A single grain of Liliaceae pollen and a small quantity of *Zea* pollen were recovered from Cist 3C, but little other pollen of note or importance in interpreting the subsistence record was recovered from these three cists. The pollen record is, therefore, unable to address which foods may have been stored within these cists, with the exception of the observation that corn may have been stored within Cist C.

Summary and Conclusions

The pollen record indicates that horticulture was practiced by the occupants of this site and that corn was utilized from the earliest occupation through the latest. Small quantities of corn pollen recovered from various locations throughout the site indicate that this resource probably played an important role within the subsistence base. Evidence of the exploitation of native plants is less obvious in the pollen record. Cheno-ams do appear to have contributed to the diet of the occupants of this site, and appear to have been stored within at least some of the surface rooms (Rooms B, C, D, and possibly F), and was regularly processed in Room E.

Very small quantities of *Cleome* pollen are present in samples collected from Room E, indicating that this resource was available for exploitation and was processed within this room. Aggregates of High-spine Compositae pollen distributed in storage Rooms B and D, the pit structure, and slab-lined storage Cist 3B, suggest that a member of this family may have been stored and processed at this site. Small quantities of Cruciferae pollen recovered in Storage Room F and from the wash of Metate 623 suggest that members of this family may also have been exploited. A single large frequency of Gramineae pollen, accompanied by aggregates, in the sample collected to the north of the hearth suggests that this area may have been used to process grass seeds. Small quantities of Liliaceae pollen recovered from the trash midden and slab-lined storage Cist 3C indicate that this resource was indeed available, and may have been processed and stored at the site. Small quantities of *Plantago* and *Polygonum* recovered from the mano wash (Room A) suggest that seeds from these resources may have been processed. *Plantago* pollen was recovered from slab-lined storage Cist 3B, suggesting that it may also have been stored. *Shepherdia* pollen was recovered only from the floor of the pit structure, indicating that this resource was available for exploitation, and that it may have been processed or used within the pit structure. Solanaceae pollen was recovered both from Room B and from the floor of the pit structure, suggesting that this resource may have been both processed and stored at this site during the earlier occupation.

Sphaeralcea pollen was recovered from almost all of the samples from the room block, but not from the pit structure, and from only one sample representing the slab-lined storage cists. It is probable that the presence of this pollen type represents transport from the local environment. The distribution of this pollen type, however, suggests that *Sphaeralcea* greens and/or seeds may have been processed and stored in all of the rooms in the surface room block. This pollen type is conspicuously absent from the trash midden outside the room block, adding further weight to the interpretation that this resource was, indeed, utilized at the site, which may be associated with processing this resource.

The presence of Typha pollen, both T. angustifolia type and T. latifolia, in samples from rooms and structures occupied throughout the life of the site, indicates at a minimum the presence of cattails within a nearby riparian vegetation community. The association of cattail pollen with a piece of ground stone (the mano recovered from the ramada), the floor beneath Metate 623, Room F, as well as the pit structure and entryway to Room E, suggests that cattails may indeed have been exploited. Additional evidence of the proximity of the riparian community is represented by the presence of Salix (willow) pollen in samples throughout the site. Several of the samples from living Room E exhibit willow pollen, including the sample taken from the north of the hearth, and the wash of Metate 623. It is possible that Salix was used by the occupants of this site, although its presence in the pollen record may document nothing more than the presence of willow within the local environment. A single grain of Umbelliferae pollen recovered from the sample north of the hearth in Room E suggests that this resource may have been processed in this area, perhaps in preparation for roasting within the hearth. Zea pollen was recovered from many samples from this site, indicating that the occupants practiced horticulture, and occupied the site for a sufficient portion of each year to plant corn and see their harvest to maturity. The presence of Zea pollen in storage rooms also indicates that this cultivated resource was stored.

CHAPTER X

FLOTATION ANALYSIS OF THE PINENUT SITE

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Introduction

Six flotation samples from the Pinenut Site [AZ B:6:44(ASM)] were processed and analyzed in conjunction with the archaeological investigations at the site. The flotation samples were collected from the fill of archaeologically-defined features (Table 10.1). Five of the samples were removed from hearths and the sixth was collected from a storage pit. Sample size prior to processing ranged from 1.0 to 4.5 liters (Table 10.2). The purpose of this investigation was to recover and identify culturally significant macrobotanical remains.

Site Description and Sample Provenience

The Pinenut Site is located on the Kanab Plateau in northwestern Arizona at an elevation of 5440 feet (1659 meters). Surface vegetation in the vicinity consists of open pinyon/juniper woodlands and sagebrush/grass communities. Surface remains included a room block (Feature 1), a pit structure (Feature 2), two slab-lined cists (Feature 3), and a trash midden (Feature 4).

The six floation samples were removed from three features. Flotation Samples 627 and 628 were collected from the east and west halves of the hearth fill associated with Feature 1, Room E. Samples 629, 630, and 631 were removed from the central hearth of Feature 2. Sample 632 was collected from the basal fill of Floor Pit E in Feature 2.

Processing and Identification

The six flotation samples were processed using a water flotation technique based on the principle that organic remains float on the surface when a soil sample is submerged and agitated in water. The floated remains (light fraction) are poured onto two layers of .5 mm screen and allowed to air dry. The part of the sample which does not float is gently water-screened in a 2.0-mm screen. All debris trapped in this screen (heavy fraction) is also air-dried. Both the light and heavy fractions of each sample were examined under a binocular scope at 10x. All possible cultural remains were separated from each sample. Seed identification is based on the author's comparative collection and on seed identification manuals (Martin and Barkley 1961; Montgomery 1978).

TABLE 10.1. Sample Provenience.

Sample Number	Feature	Horizontal Provenience	Vertical Provenience	Comments
627	1	Room E	110-116 cm B.D.	East half of hearth fill
628	1	Room E	110-116 cm B.D.	West half of hearth fill
629	2	Hearth		West half fill from central hearth
630	2	Hearth		East half fill from central hearth
631	2	Hearth		Lower fill from central hearth
632	2	Floor Pit E	Level 3	Basal fill of pit

TABLE 10.2. Sample Size (Liters).

Sample Number	Original Volume	Light Fraction Volume	Heavy Fraction Volume
627	2.25	.050	.200
628	2.50	.075	.225
629	4.50	.150	.540
630	4.25	.320	.530
631	4.00	.175	.400
632	1.00	.100	.100

Results

The results of the analysis are summarized in Table 10.3. One hundred thirty-three seed or seed fragments and five other identifiable macrobotanical remains were recovered. These remains represent 16 taxa. Fifty-three of the seed occurrences (40%) are charred. Forty-six of the charred seeds (87%) are from the same species.

Charcoal was noted in all of the flotation samples (Table 10.4). Although many of these pieces are too fragmentary to be identified, those pieces which were identifiable appear to be pinyon pine or juniper.

Twelve small bone fragments and eighteen small interior flakes were recovered (Table 10.5). Two of the twelve bone fragments are charred. Most of these fragments appear to be those of small mammals or reptiles. A pottery sherd was also associated with Sample 627.

TABLE 10.3. Macrobotanical Results (all seeds unless otherwise noted).

Sample			Charred		Uncharred	
Number	Identification	Common Name	whole	fragment	whole	fragment
627	Chenopodium	Goosefoot	18			
	Sphaeralcea	Globe Mallow	1			
	cf. Rumex or Polygonum	Dock or Knotweed			1	
628	Chenopodium	Goosefoot	4			
	Helianthus	Sunflower	1			
629	Chenopodium	Goosefoot	3			
	Juniperus	Juniper			3	
	Physalis	Groundcherry			1	
	Pinus cf.edulis*	Pinyon Pine		1		
	Sphaeralcea	Globe Mallow				1
	Zea**	Corn		2		
630	Chenopodium	Goosefoot	8			
	Echinocereus	Hedgehog Cactus	1			
	Juniperus	Juniper			2	2
	Physalis	Groundcherry	1			
	Pinus cf.edulis*	Pinyon Pine		1		
	Sporobolus	Dropseed Grass			1	
	cf. Compositae	Sunflower Family			2	
	Unknown	Unknown				1
631	Chenopodium	Goosefoot	8	1		
	Physalis	Groundcherry			2	
	Pinus cf.edulis*	Pinyon Pine		1		
	cf. Compositae	Unknown			1	
632	Amaranthus	Pigweed			12	
	cf. Amaranthus	Pigweed	3			
	Chenopodium	Goosefoot	4			
	Juniperus	Juniper			31	2
	Poaceae	Grass Family			1	1
	Rubus	Rasp/Blackberry			4	7
	Sporobolus	Dropseed Grass			2	
	Taraxacum	Dandelion			3	
Total			52	6	66	14

* needle fragments
** cob fragments

TABLE 10.4. Charcoal Amounts.

Sample	Charcoal Amount	
Number	Light	Heavy
627	H	T
628	H	T
629	M	T
630	A	T
631	L	T
632	L	T

T = trace, less than 1% charcoal, by volume

L = light, 1-10%

M = moderate, 11-50%

H = heavy, 51-90%

A = abundant, over 91%

TABLE 10.5. Bone and Lithic Remains.

Sample Number	Number of Lithics	Number of Bone Fragments*	Number of Pottery Sherds
627	2	2/0	1
628	3	2/0	
629	6	3/0	
630		3/2	
631	2		
632	5		

* uncharred/charred

Interpretation

As mentioned above, 53 of the 133 recovered seeds are charred. These 53 seeds represent six species: Amaranthus sp. (pigweed), Chenopodium sp. (goosefoot), Echinocereus sp. (hedgehog cactus), Helianthus sp. (sunflower), Physalis sp. (groundcherry), and Sphaeralcea sp. (globe mallow). Two charred Zea (corn) cob fragments and three charred Pinus cf. edulis (pinyon pine) needle fragments were also recovered. The 80 uncharred seeds are considered to be contaminates in the archaeological record. This concept is supported by the modern condition of these remains, the unlikelihood that uncharred items would preserve through time (Minnis 1981), and the availability of the parts in the present local environment.

The majority (87%) of the charred seeds are Chenopodium (goosefoot). Charred seeds of this species were found in every sample. These small black seeds are generally whole and are lightly parched. The lone goosefoot seed fragment is probably the result of breakage during flotation processing and not the result of intentional prehistoric modification. Goosefoot seeds are common components in many archaeological sites. The plants exhibit a wide variety of characteristics and can range in height from a few inches to several feet. The small goosefoot flowers and seeds cluster near the tips of the stems. These typically weedy and common plants can be found throughout North America in a wide range of habitats and can be very abundant locally. Although several of the *Chenopodium* species currently found in North America are introduced (including *C. album* and *C. glaucum*), native species (including *C. desiccatum* and *C. lepophyllum*) are also common (Kearney and Peebles 1951:251-254; McDougall 1973:149-152; Parker 1972:100-105).

Goosefoot use is well documented in the archaeological record as well as in many ethnographic accounts. Cushing (1920:245) noted that goosefoot "...is probably the richest and most delicious ever known either to the ancient or modern Zuni..." Other ethnographic sources report the seeds were gathered and eaten whole or ground raw or parched. The plant could also be eaten as greens or as a potherb and the flowers of some species are edible (Bye 1972; Castetter 1935; Chamberlin 1911; Gilmore 1913, 1977; Harrington 1967; Hocking 1956; Kearney and Peebles 1951; Kelly 1964; Niethammer 1974; Rogers 1980; Steward 1933, 1938; Whiting 1939; Yanovsky 1936).

Goosefoot was used for several medicinal and utilitarian purposes. It was applied as a poultice and made into a tea wash for rheumatism (Niethammer 1974:114). The leaves (sometimes mixed with stems) were chewed and brewed as an emetic (Steward 1933:317; Zigmond 1981:19), and steeped to create a vapor which was inhaled to cure headaches (Stevenson 1915:45). The leaves were also used to dye bows and arrows green (Gilmore 1977:26; Rogers 1980:66), and a green dye was extracted from the young shoots (Johnson 1970:311). Soap was made from the root (Zigmond 1981:19).

Goosefoot plants appear in the early spring and grow through the fall. Dependent upon species, the plant is available as a green in the spring, summer, or fall (Bye 1979:20). The flowers bloom from mid-spring through mid-summer. The seeds generally mature in the fall (Kelly 1964:152), but may also mature in late summer. Each plant produces hundreds of small dark seeds which were collected in several ways. A closely-woven tray was placed at the base of the plant and the plant was beaten causing the seeds to fall into the tray (Cushing 1920:244-245). The seed clusters were also gathered and dried before threshing the seeds out (Steward 1933:243). These seeds were dried for future use (Castetter 1935:23; Vestal 1952:25).

The three whole charred *Amaranthus* (pigweed) occurred in Sample 632 from Floor Pit E in Feature 2, the pit structure. Pigweed is similar to goosefoot in habitat and economic use. Pigweed is variable in appearance and height. The plants have small flowers and produce an abundance of small dark seeds. As with goosefoot, pigweed tends to be weedy and is common in several habitats. Several native species of *Amaranthus* (including *A. fimbriatus* and *A. graecizans* [*A. blitoides*]) in addition to introduced species (including *A. retroflexus*, *A. leucocarpus*, and *A. cruentus*) are common in northern Arizona (Kearney and Peebles 1951:265-267; McDougall 1973:155-157; Parker 1972:114-119).

Ethnographic reports note that young pigweed plants were often boiled and eaten as a potherb or as greens. The seeds were also parched and ground into a meal. Pigweed has many medicinal uses including as a mild astringent and a tea for stomach disorders. The plant is most useful as a green or a potherb while it is tender in the early spring. The seeds could be gathered during the late summer or fall, and were often stored for future use (Castetter 1935; Chamberlin 1911; Harrington 1967; Kearney and Peebles 1951; Moore 1979; Palmer 1878; Robbins et al. 1916; Stevenson 1915; Whiting 1939).

The lone *Echinocereus* (hedgehog cactus) seed in Sample 630 from the central hearth of Feature 2, the pit structure is from a low-growing cylindric cactus. Hedgehog cactus rarely grows taller than 50 cm (Dodge 1976:97; Nelson 1979:199-200). *Echinocereus viridiflorus* ranges from southern Wyoming to New Mexico and western Texas at elevations below 7500 feet (Patraw 1977:71). *Echinocereus melanacanthus* (*E. Triglochidiatus* var. *melanacanthus*) and *Echinocereus triglochidiatus* are common in the pinyon-juniper belt of Colorado, Utah, New Mexico and Arizona from 4,000 to 9,000 feet (McDougall 1973:321; Patraw 1977:45).

The showy hedgehog cactus flowers appear in a variety of colors and produce juicy edible fruits with readily detachable spine clusters The Pima Indians of southern Arizona consider these fruits a delicacy (Dodge 1976:97). Although the hedgehog cactus is available throughout the year, the pulp is the most palatable in the spring through the fall. The fruits ripen in the late summer and fall with the seeds maturing in the fall. Cactus parts, primarily *Opuntia* species (prickly pear), are noted in the ethnographic record as having been stored for future use. Storable parts include seeds and the fruits, often with the seeds (Balls 1975; Castetter 1935; Cushing 1920; Gilmore 1977; Harrington 1967). Other reports indicate that prickly pear was not stored (Kelly 1964:45; Steward 1938:26).

One whole charred *Helianthus* (sunflower) seed was found in Sample 628 from the hearth in Room E. This seed represents a showy plant which can grow to a height of several feet. Sunflowers have large yellow and brown flowers with large coarse leaves. Several sunflower species are common in northern Arizona, including the showy *H. annuus* and the smaller *H. petiolaris* (McDougall 1973:538). *H. annuus* was probably introduced to Arizona from the central United States (Parker 1972:298; USDA 1971:418).

Historically, sunflower seeds were eaten whole or ground and raw or parched. Cushing (1920:253) noted that at Zuni the seeds were often "...slightly ground on a fine-grained stone" The seeds were roasted and brewed, oil was extracted from them, and the inner bark was chewed (Bye 1972; Castetter 1935; Chamberlin 1911; Craighead et al. 1963;

Cushing 1920; Harrington 1967; Hocking 1956; Kelly 1964; Newberry 1888; Niethammer 1974; Rogers 1980; Steward 1938; Vestal 1952; Yanovsky 1936; Zigmond 1981). 1974:53).

Sunflowers were also used for numerous medicinal and utilitarian purposes. The flower heads were used to cure chest pains or pulmonary problems and the crushed seeds were given to nursing mothers (Gilmore 1913, 1977). An extraction of the leaves cures fever and a leaf poultice was applied as a snake bite cure (Niethammer 1974:54). Stevenson (1915: 53) reports that a mixture of sunflower root and other roots was also used as a cure for rattlesnake bites. A liquid made of the roots was used as a wash for rheumatism (Niethammer 1974:54). Yellow dye was extracted from the flowers and a purple dye was made from the seeds (Craighead et al. 1963; Niethammer 1974).

Sunflowers usually bloom in the late summer and remain through mid-fall. The seeds were gathered in the fall by either beating the flower heads to cause the seeds to fall into a basket, or by pounding the flowerheads in a basket to separate the seeds (Chamberlin 1911; Niethammer 1974; Zigmond 1981). Sunflowers could be stored for future use.

A single charred Physalis (groundcherry) seed was recovered from Sample 630 from the hearth in Feature 2. Groundcherry species are generally low-growing weedy plants with purple or yellow flowers. Species probably native to northern Arizona include P. heterophylla, P. lobata, and P. wrightii (McDougall 1973:431-433; Parker 1972:260; USDA 1971:320). The edible fruits were consumed raw or cooked, whole or ground, and fresh or dried and often were dried for future use (Castetter 1935; Craighead et al. 1963; Gilmore 1913, 1977; Harrington 1967; Hocking 1956; Niethammer 1974; Robbins et al. 1916; Rogers 1980; Stevenson 1915; Vestal 1952; Whiting 1939; Yanovsky 1936). Gilmore (1977:61) reports that the roots of some species of groundcherry were smoked as an unspecified treatment and that it was made into a healing tea or applied to wounds.

A complete charred Sphaeralcea (globe mallow) seed is associated with Sample 627 from the hearth in Room E. Globe mallow plants are generally two to ten inches tall with small orange or red flowers. All Sphaeralcea species found in northern Arizona are probably native to the region (Kearney and Peebles 1951:540-547; McDougall 1973:308-311; Parker 1972:214). There are several ethnographically-reported uses for globe mallow. Some globe mallows have edible seeds or stems which were chewed and various species have external and internal medicinal uses. Globe mallow plants are available in the spring, summer, and fall. They generally bloom in the late spring through summer with seeds maturing in late summer and fall (Castetter 1935; Johnson 1970; Kearney and Peebles 1951; Moore 1979; Robbins et al. 1916; Rogers 1980; Vestal 1952; Whiting 1939).

Both species of non-seed charred macrobotanical remains also represent prehistoric plant use. The three *Pinus* cf. *edulis* needle remains in the fill of the central hearth in Feature 2 probably represent the use of pinyon wood as fuel or as construction material. The two corn cob fragments also recovered from this hearth are common components of Virgin Anasazi sites.

All six plant species represented by the charred seeds, in addition to the corn remains, mature in the fall and were probably collected at that time. Although the seeds and corn may have been utilized soon after collection, they may also have been stored for future use. Because of this, no conclusive determination of site seasonality is possible. The seeds were probably locally procured. All represent fairly common plants which were probably locally available during the occupation of the site.

Summary and Conclusions

Six flotation samples were analyzed from the Pinenut Site. One hundred thirty-three seeds and five other identifiable macrobotanical remains were recovered from these samples. The fifty-three charred seeds represent possible prehistoric use of six plant species. The three *Pinus* cf. *edulis* needle fragments, in conjunction with the pine charcoal, indicate the use of pine for fuel or as a construction material. Two *Zea* (corn) cob fragments were also recovered. The majority (46, or 87%) of the charred seeds are *Chenopodium* sp. (goosefoot) and other charred seeds included three *Amaranthus* sp. (pigweed), one *Helianthus* sp. (sunflower), one *Echinocereus* sp. (hedgehog cactus), one *Physalis* sp. (groundcherry), and one *Sphaeralcea* (globe mallow). All six species of charred seed remains represent plants with reported ethnographic uses that may have also been economically significant for the prehistoric inhabitants of the Pinenut Site. The goosefoot seeds occurred in the central hearth and Floor Pit E of Feature 2 (the pit structure), and also in the hearth of Room E in Feature 1. Only limited amounts of the other five charred seed species were recovered. These seeds probably represent prehistoric plant use, but may also be the result of incidental charring. The seeds were probably locally procured in the fall but could have been utilized during any season.

CHAPTER XI

SUMMARY AND CONCLUSIONS

The main research focus of this study is to evaluate the function and role of the Pinenut Site in the context of Anasazi adaptational strategies on Water Canyon Point. As stated in Chapter III the study of site material culture was organized under five interrelated problem domains: Chronology, Environment, Subsistence, Technology, and Logistical Organization. Interpretation of site data pertinent to these problem domains have been presented in the foregoing analysis chapters; hereinafter the data from the Pinenut Site will be summarized and evaluated in the larger context of Anasazi adaptational strategies on Water Canyon Point. As well, the synchronic events of the prehistory of Water Canyon Point will be studied to evaluate diachronic processes in the prehistory of northwestern Arizona.

The inhabitants of the Pinenut Site were clearly associated with the Virgin Anasazi cultural tradition as indicated by diagnostic architectural and ceramic assemblage attributes. Cumulative evidence revealed that the site was occupied during at least three distinct episodes. The initial settlement of the site probably occurred during the A.D. 1050 to 1100 interval, or middle Pueblo II times. After a hiatus some time between A.D. 1100 and 1200, the site was re-occupied at some point in the A.D. 1200 to 1250/75 interval. During this time some earlier structures fell into disuse, others were re-occupied, and new structures were build in two discrete construction episodes. This construction-occupation sequence is thought to represent three distinct occupational phases which may have temporal significance. The final abandonment of the Pinenut Site probably occurred around A.D. 1275.

Throughout the occupational history of the Pinenut Site the number and function of architectural features in use at any one time was relatively constant (Chapter V). Each of the three occupational episodes is characterized by the use of a dwelling, a storage room, an activity room adjacent to the storage room(s), and an isolated slab-lined cist. The record of low variation in structure function is mirrored in the respective artifact assemblages that reveal little change in their numerical and functional attributes through time. It appears, then, that the Pinenut Site was used by a small family group at ony one time and that the composition and structure of each group was essentially the same over time. This might explain the consistent co-occurrence of Virgin Series, Moapa Ware, and Shinarump Ware in nearly equal proportions for each occupational episode. Clearly, a strong element of conservatism prevailed throughout the occupational history of the Pinenut Site.

The pollen analysis (Chapter IX) revealed that corn (Zea) was present in small quantities on the floors of every feature on the site except Features 3A and 3C. Also noteworthy is the occurrence of cattail pollen (Typha) in Feature 2, the pit structure, and in Rooms A, E, and F of Feature 1. These features are distinguished by their non-storage utilitarian function, implying the procurement and processing of cattail for immediate consumption rather than for long-term storage. This may reflect a seasonal emphasis. More important, the presence of cattail pollen, along with willow (*Salix*) indicates a nearby source of permanent water. At present, the nearest accessible sources of permanent water are springs in Hack Canyon and in side canyons of Kanab Creek Canyon north and southeast of the Pinenut Site, respectively. Such springs may have been utilized by the Pinenut Site inhabitants not only for water but also for their associated wild resources; moreover, upland water catchments on Water Canyon Point also may have supported these plant species (data on file: BLM Arizona Strip District Office).

In addition to corn, cattails, and willow, the Pinenut Site inhabitants also collected a variety of wild economic plants: goosefoot (*Chenopodium*), pigweed (*Amaranthus*), hedgehog cactus (*Echinocereus*) sunflower (*Helianthus*), beeweed (*Cleome*), groundcherry (*Physalis*), pinyon nuts (*Pinus edulis*), dropseed grass (*Sporobolus*), dandelion (*Taraxacum*), plantain (*Plantago*), dock or knotweed (*Rumex*), and globe mallow (*Sphaeralcea*) (Chapters IX and X). Of these, goosefoot and pigweed pollen occurred in aggregates in Rooms C and D, suggesting these plants were stored along with corn in the storage rooms. These weedy plants are commonly represented in archaeological sites throughout the Anasazi region and Lindsay (1981) has suggested that they may have been encouraged along with domesticated plants in horticultural fields. The grinding tool kits associated with the processing of plant materials at the site uniformly exhibits a lack of formal techno-morphological attributes; this implies that both domesticated and wild resources were only minimally processed to reduce them to a lower-bulk size for storage and/or transport or for immediate consumption. Lastly, the the Pinenut Site is distinguished by the recovery of only three small fragments of mammalian bone, all from Room E. It seems unlikely that preservation factors alone would account for this remarkably low frequency of faunal bone. Noteworthy also is the total absence of bone tools. However, given the recovery of projectile points and other tools associated with animal resource processing (Chapter VIII), it is plausible that some hunting was practiced, but may not have been an important activity during the occupation of the Pinenut Site.

In sum, subsistence data and material culture patterns show that the Pinenut Site inhabitants practiced a mixed subsistence strategy that incorporated horticulture and wild plant collecting. These activities indicate occupation of the site during the summer season. The low incidence of faunal bone might be considered negative evidence indicating that occupation did not continue into the fall and winter. Instead, the site inhabitants may have moved and transported their stored horticultural surplus to a fall-winter settlement located elsewhere. Additional evidence supporting a seasonal summer occupation is the nature and composition of the trash midden. The midden is shallow and unstratified, indicating relatively brief depositional episodes. Also, ceramics from the midden (and also from the site structures) are distinguished by a relatively high ratio of jars to a low ratio of bowls. These relative frequencies not only indicate a high storage capacity at the site, but also that food preparation, serving, and consumption was relatively unintensive (cf. Westfall et al., in press).

At this time, a potential winter settlement has not been identified on Water Canyon Point. It seems unlikely that the Pinenut Site inhabitants moved into the Grand Canyon, since there is little evidence of Virgin Anasazi habitation of the Inner Canyon and also there is little to indicate that the site inhabitants interacted with Kayenta Anasazi groups who inhabited the Inner Canyon (cf. Schwartz et al. 1980). If the Moapa Wares and Shinarump Wares are assumed to represent geographically distinct ceramic traditions, then it is possible that the occurrence of these wares indicate that group movement and possibly exchange occurred between the Mount Trumbull area to the southwest or the Upper Kanab Creek drainage area to the northeast, respectively. The resolution of this problem must await future research not only on Water Canyon Point, but within these two geographical areas as well.

In summary, the Pinenut Site represents one example of an adapatational strategy that was implemented on Water Canyon Point. This involved seasonal summer occupation for the purpose of acquiring a surplus of horticultural produce, supplemented by wild plant collecting and minor hunting of game. The strong element of conservatism evident in site architecture, material culture assemblages, and site function shows that Virgin Anasazi groups were successful at implementing this subsistence strategy during the A.D. 1050 to 1100 interval and again during the A.D. 1200 to 1250/1275 time span until conditions forced the final abandonment of the site. It is apparent that the occupational history of the Pinenut Site is closely aligned with environmental and cultural factors. Euler and others (1979) and Dean and others (1985) have proposed a general model of paleoenvironmental and demographic change for the southern Colorado Plateaus to account for Anasazi culture change through time. This model is graphically summarized in Figure 11.1 (top). Below this decadal, tree growth departures are graphically shown as measures of regional precipitation (Jeffrey S. Dean: personal communication to Euler 1987). The radiocarbon dates from the Pinenut Site are indicated on this lower figure to illustrate precipitation regimes during the occupational history of the site. These data will be used to evaluate the adaptive responses made by the Pinenut Site inhabitants to prehistoric environmental and cultural factors through time.

As noted, the A.D. 1050 to 1150 interval on the southern Colorado Plateaus was characterized by high spatial variability in climatic conditions and a generally salubrious environment. These conditions are thought to have favored settlement of a variety of microenvironments by a growing population and also would have stimulated intergroup interaction (Dean et al. 1985:543-544). Such conditions may have stimulated the settlement of Water Canyon Point by the Virgin Anasazi. Survey data on file at the BLM Arizona Strip District Office show that a number of other Virgin Anasazi habitations, field houses, water control systems, and formal C-shaped pueblos occur on Water Canyon Point in the near vicinity of the Pinenut Site. These settlement data are complemented by site distributional data for the Arizona Strip and adjacent Grand

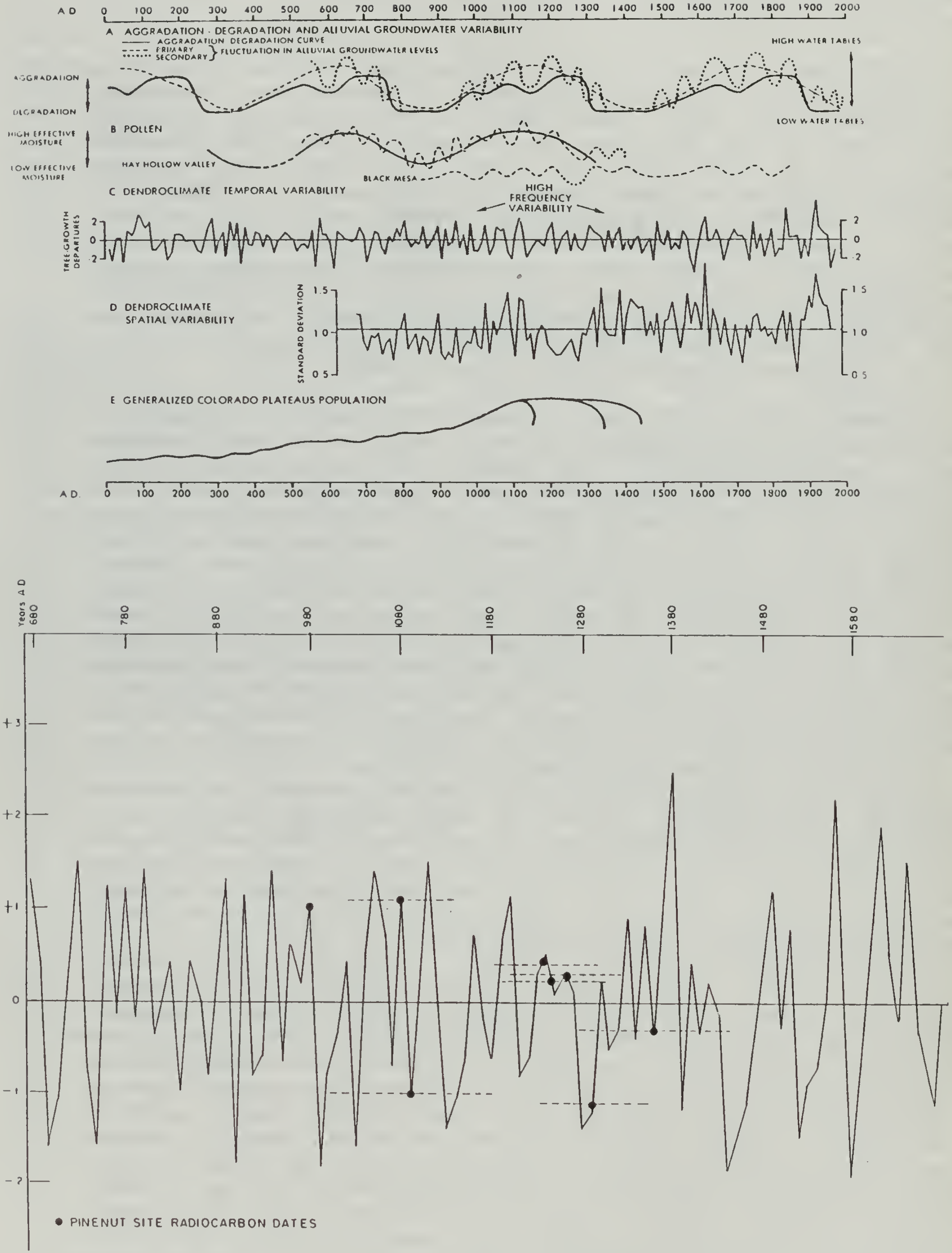

Figure 11.1. Top: Generalized sequence of environmental and demographic variability on the southern Colorado Plateaus (from Dean et al. 1985).
Bottom: Decadal tree-growth departures .

Canyon regions which show significant population growth and expansion during the A.D. 1050 to 1150 time span (Aikens 1966; Effland et al. 1981; Janetski and Hall 1983; Jones 1985; Nickens and Kvamme 1981; Schwartz et al. 1980; Schwartz et al. 1981). Evidence for population interaction on Water Canyon Point might be indicated by a few sites which exhibit both Virgin Anasazi and Kayenta Anasazi ceramics; however, the occupants of the Pinenut Site do not seem to have participated in this interaction sphere as shown by the very low incidence of Kayenta Anasazi ceramics in the material culture assemblage. Rather, interaction seems to have been restricted to inter-group exchange within the confines of the Virgin Anasazi cultural tradition as indicated by co-occurrence of Virgin Series, Moapa Ware, and Shinarump Ware in the site's ceramic assemblage.

The A.D. 1150 to 1200 interval on the southern Colorado Plateaus was a period of deteriorating hydrologic conditions exacerbated by a drought. These conditions were accompanied by widespread population dislocations and the collapse of regional alliances and interaction spheres across large areas of the southern Colorado Plateaus around A.D. 1150. Virgin Anasazi populations at this time had largely abandoned the Virgin River area and large segments of the Kayenta Anasazi population had also abandoned the Grand Canyon region, although there are indications that some small population groups may have remained in some localities (Effland et al. 1981; Jones 1985; Thompson and Thompson 1974; Walling et al. 1986). Hence, the A.D. 1100 to 1200 occupational hiatus at the Pinenut Site may indicate a negative response to poor environmental conditions during the A.D. 1100 to 1200 interval. Other sites on Water Canyon Point also may have been abandoned at this time, and the rarity of post-A.D. 1150 Kayenta Anasazi ceramics could indicate the cessation of Virgin-Kayenta exchange relationships due to the abandonment of the region by the Kayenta Anasazi.

The subsequent A.D. 1200 to 1275 interval was marked by a gradual return to high water tables, aggraded floodplains, but generally low precipitation (Dean et al. 1985:543). A Virgin Anasazi group re-occupied the Pinenut Site probably during this time. The significant representation of Shinarump Corrugated ceramics associated with the later occupation features at the site might indicate that this group may have come in from the Upper Kanab Creek drainage area. The presence of cattail, willow, and corn pollen in the later rooms of the site indicate that in the vicinity of Water Canyon Point there was sufficient water to permit horticulture. Possibly, the higher water tables may have stimulated the flow of springs in the canyons surrounding Water Canyon Point; these may have alleviated the otherwise dry precipitation regime. Also, higher water tables may have favored the retention of surface water in natural or artificially augmented catchments. Hence, Water Canyon Point may have retained sufficient environmental necessities to sustain a small population for a short period of time. Nonetheless, the smaller storage capacity of the latest storage room (Room D) at the site hints at lessened crop yields, and the special care taken in the durable construction of this room suggests that stored surplus was especially precious to the group during this time. This could reflect the general trend toward decreasing precipitation and consequent high risk for horticulture beginning around A.D. 1230.

Finally, beginning around A.D. 1250 and continuing to A.D. 1300 the celebrated Great Drought dealt the remnant Anasazi populations a severe blow. The final abandonment of the Pinenut Site around A.D. 1275 no doubt reflects the failure of Water Canyon Point to sustain a horticultural subsistence base under the extreme conditions of this interval. The internal conservatism of the Virgin Anasazi group who occupied the Pinenut Site was, in the final analysis, perhaps inadequate to meet this challenge. Water Canyon Point was not inhabited again until Southern Paiute hunter-gatherers came into the area around A.D. 1300 in response to the next cycle of climatic amelioration.

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APPENDIX I

CERAMIC ATTRIBUTE LIST
(Adapted from Blinman 1986)

Site No.:

Speciman Bag No.:

Temper/Paste Classification:

1. Rounded quartz grains predominate, various sizes; white cement (matrix) material; bound quartz particles common; copious amount of plastics; porous gray paste. Crushed sandstone.
2. Angular to round quartz grains, well mixed, porous to apparently vitrified. Sand.
3. Dark angular quartz grains with white fragments and occasional grains of olivine; well mixed; gray to dark gray. Moapa derivitive.
4. Light, fine gray, crushed rock, angular particles with small amount of olivine; well mixed; light gray.
5. Coarse olivine grains, often in aggregates; coarse to fine paste; light to dark gray.
6. Multilithic sand with olivine grains, light tan to gray well-mixed paste. Like No. 11 below but with olivine.
7. Multisize angular white rock with occasional rounded quartz grains in fine light gray to gray paste.
8. Multisize light-colored rock with occasional angular quartz grains in coarse dark gray to black paste.
9. Like No.1 above but with dark gray to black paste; appears vitrified.
10. White and light gray angular fragments in a fine gray paste; rare quartz or olivine grains.
11. Fine multilithic sand; well mixed in light gray paste, may appear vitrified, like No. 6 above but without olivine.
12. Fine multilithic sand; well mixed; oxidized colors-red; some rounded quartz grains.

13. Angular debris/multilithic sand with olivine and quartz grains; well mixed; gray paste.

14. Rounded single quartz grains and rounded light gray to white rock; dark gray paste. Possibly a stream or arroyo gravel (sand).

15. Small fragments of light-colored (sherd) with olivine and quartz grains; porous gray to light gray paste. Crushed sherd temper.

FA: Firing Atmosphere

2 - reduced, light color (i.e., light gray to white)
3 - reduced, dark color (dark gray-gray brown)
4 - reduced, poorly (black)
5 - oxidized (warm colors)

Surface Manipulation:

1 - indeterminate
2 - plain (wiped, scraped or smooth but uneven)
3 - fileted
6 - corrugated
8 - smooth but not lustrous
9 - polished

Cover:

1 - indeterminate
2 - none
3 - fugitive red
4 - slipped

Pigment Type:

1 - indeterminate
2 - none
3 - organic paint
4 - mineral paint
5 - mixed organic/mineral

Pigment Color:

0 - not applicable
1 - indeterminate
2 - none
3 - brown/black
4 - red/orange
5 - white
6 - polychrome (red and black)
7 - polychrome (red, black, and white)
9 - other

Prefiring Form:

00 - not applicable
01 - indeterminate
02 - bowl
03 - seed jar
04 - olla
05 - cooking/storage jar
06 - pitcher
07 - indeterminate olla, cooking/storage, pitcher
08 - jar body
09 - bowl or jar body
10 - feather box
11 - "bird" effigy
12 - "submarine" effigy
13 - "dog" effigy
14 - other or indeterminate effigy
15 - figurine
16 - miniature vessel
17 - lug handle
18 - strap handle
19 - coil handle
20 - recessed handle
21 - open gourd dipper
22 - bowl dipper
23 - bowl dipper handle
24 - pipe
25 - ball or lump
26 - coiled applique
27 - vertical pinch
99 - other

Post-firing Modification:

00 - not applicable
01 - indeterminate
02 - none
03 - ceramic scraper
04 - saucer form (abraded)
05 - saucer form (chipped)
06 - repair hole to maintain original form
07 - pendant
08 - jar modified into bowl
09 - olla modified into seed jar
10 - rim reshaped without changing vessel form
11 - dipper wear
12 - rim chippage wear
13 - pendant blank
14 - small regular form (abraded)
15 - small regular form (chipped)
16 - handle sherd, abraded at break from vessel
17 - vessel sherd, abraded at break from handle
19 - rounded sherd edge
20 - inner beveled sherd edge

21 - outer beveled sherd edge
22 - multiple beveled sherd edge
23 - chipped sherd edge
24 - scoop
99 - other

Rim Shape:

1 - lip straight, tapers to round
2 - lip everted 90°
3 - straight lip, slightly tapered
4 - straight lip, rounded
5 - corrugated lip, everted to ca. 45°
6 - plain, lip tapers to round with 15° eversion.

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